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Reducing incision length or intensifying rehabilitation: what makes the difference to length of stay in total hip replacement in a UK setting?

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Abstract Minimal-incision surgery for hip arthroplasty and intensive post-op physiotherapy have both been shown to allow early mobilisation and to reduce hospital stay. Forty-five patients undergoing primary total hip arthroplasty using a standard posterior approach were compared with 51 patients using a minimal incision. In both groups, physiotherapy involved either a routine or intensive regime. Patients were matched in age, sex and body mass index. There was no significant difference in blood loss, post-operative stay and change in Oxford hip scores at one year between the mini- and standard-incision groups. There was a significant difference ($P=0.003$) in length of stay between routine- and intensive-physiotherapy groups (11.4 vs. 7.9 days). The dislocation rate was higher in the mini-incision group. This study suggests that in a standard UK setting, intensive physiotherapy can significantly decrease in-patient stay, but reducing the incision length does not.

Résumé La technique mini-invasive dans la chirurgie de la hanche et une rééducation intensive post-opératoire ont montré que l'on pouvait d'une part mobiliser précocement les patients et réduire la période d'hospitalisation. 45 patients devant bénéficier d'une arthroplastie totale ont été opérés par voie postérieure standard comparés à 51 patients

utilisant une voie mini-invasive. Dans les deux groupes, la physiothérapie était soit classique, soit intensive. Le sexe ratio, l'âge et le BMI des patients sont comparables. Il n'y a pas de différences significatives au niveau de la perte sanguine, de la durée moyenne de séjour et dans le score de hanche de type Oxford à un an post-opératoire entre les deux groupes. Il y a une différence significative dans la durée moyenne de séjour (11,4 jours d'hospitalisation pour l'incision standard, 7,9 pour la mini-incision). Le taux de luxations est plus important dans le groupe de la voie mini-invasive. Cette étude suggère qu'une voie d'abord standard avec une physiothérapie intensive peut diminuer, de façon significative, la durée moyenne de séjour, cette réduction n'est pas suffisamment importante en utilisant la technique de chirurgie mini-invasive.

Introduction

Currently post-operative hospital stays for total hip replacements range from 4–15 days [9, 12, 16, 17] with UK stays tending to be at the higher end [16]. The trend in recent years is to reduce length of stay to improve use of resources. Some literature examining post-operative physiotherapy and length of hospital stay has shown that early intensive physiotherapy reduces post-op stay [5, 9, 12], but others have shown that it makes little difference [10]. Minimal-incision surgery for total hip arthroplasty may also allow earlier mobilisation and reduce hospital stay although again opinion varies, particularly under the constraints of a UK setting [15, 17–19]. The purpose of this study was to assess the separate effects of minimal-incision surgery and intensive post-op physiotherapy on reducing hospital stay following primary total hip arthroplasty.

Patients and methods

We examined 96 patients undergoing primary total hip arthroplasty for osteoarthritis across two hospital sites

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retrospectively. One was a National Health Service (NHS) Hospital and the other a private hospital. There were 45 patients (26 NHS and 19 private) undergoing primary total hip arthroplasty using a standard posterior approach and 51 patients (29 NHS and 22 private) with an incision of 10 cm or less. The standard posterior approach involved division of piriformis, the short external rotators including quadratus femoris and the posterior capsule but without an anterior capsulotomy. The mini posterior approach included cutting of the piriformis, obturator and gemelli but not quadratus femoris. The posterior capsule was repaired and piriformis reattached in all patients. These were the first group of minimal-incision operations performed by the senior author. Cemented, uncemented and hybrid implants were used depending on the age and activity of patients, but all patients were mobilised fully weight-bearing on the first post-operative day regardless of implant. Physiotherapy involved once-daily weekday sessions with the NHS patients (five sessions per week) versus twice daily with the private patients (14 sessions per week). All private patients had a planned hospital stay of 10 days, and there was no financial incentive to discharge them earlier than this.

The senior author performed or was scrubbed in theatre, directly supervising all procedures. Antibacterial prophylaxis using one pre-operative dose and two post-operative doses of a second-generation cephalosporin was standard throughout all procedures. Antithrombotic prophylaxis involved the use of mechanical calf compression boots if available or a daily injection of a low-molecular-weight heparin during the hospital stay. All patients followed the same care pathway for total hip replacement regardless of hospital. A standardised objective set of criteria were used for discharge: patients should be independently mobile, safe on crutches or an appropriate aid, safe on stairs and aware of their post-operative limitations.

Variables assessed were patient age, gender, body mass index (BMI), length of scar, post-operative stay, blood loss, complication rates and Oxford hip scores. Data were collected by case-note review, out-patient follow-up clinics and telephone interviews. The data were analysed with SPSS for Microsoft Windows, Release 10.0 (SPSS, Chicago, IL). The chi-squared test was used for non-continuous data and the unpaired *t*-test or Mann-Whitney *U*-test used depending on whether the data were normally distributed or not. A *P* value of less than 0.05 was considered to be statistically significant.

Results

Patient demographics in the four groups are summarised in Table 1. There was no significant statistical difference between any of the four groups with respect to sex distribution, age at operation, body mass index or implant used.

Pre-operative Oxford hip scores (OHS) were recorded in routine out-patient clinics (Table 2). The OHS taken pre-operatively showed no significant differences between the

Table 1 Patient demographics and prosthetic implants used in the four patient groups

	Standard incision Routine physio	Minimal incision Routine physio	Standard incision Intensive physio	Minimal incision Intensive physio
Number	26	29	19	22
Females	15 (58%)	19 (66%)	9 (47%)	13 (59%)
Age at operation (years) (mean±SD)	70±9.6	71±10.0	70±11.3	71±9.7
BMI (kg/m ²) (mean±SD)	26±3.8	26±3.8	27±4.1	25±3.9
Implant used (%)				
Cemented	21 (81%)	21 (73%)	12 (63%)	16 (73%)
Uncemented	0 (0%)	1 (3%)	0 (0%)	0 (0%)
Hybrid	5 (19%)	7 (24%)	7 (37%)	6 (27%)

two routine physiotherapy groups (*P*=0.437) or between the two intensive physiotherapy groups (*P*=0.583). There was a significant statistical difference between the NHS patients and the private patients (45 vs. 38, *P*=0.001) as a whole. The pre-operative scores were measured at the time of listing the patient for surgery. In the NHS system at the time of the study, there was approximately a 9- to 12-month wait between listing and the operation taking place, in the private system this was 4 weeks. We have separately noticed an increase in Oxford scores during the wait for surgery, but this was not specifically analysed in the study.

The scar lengths were measured at a mean of 17 months post-operatively. The length of scar (mean±SD) in the standard incision group was 15.4±2.6 cm; the minimal incision group was significantly shorter at 8.3±1.5 cm (*P*=0.0001). Blood loss was measured as the decrease in haemoglobin from the pre-op measurement to the measurement taken on the first post-operative day. There was no significant difference across all four groups.

There were no significant differences in mean hospital stay (Table 3) between the two routine-physiotherapy groups (11.9 vs. 10.9 days, *P*=0.166) or between the two intensive-physiotherapy groups (7.9 vs. 7.8 days, *P*=0.937). There was a significant difference between the two standard-incision groups (11.9 vs. 7.9 days, *P*=0.001) and between the two minimal-incision groups (10.9 vs.

Table 2 Oxford hip scores (OHS) for the four patient groups

	Standard incision Routine physio	Minimal incision Routine physio	Standard incision Intensive physio	Minimal incision Intensive physio
Pre-op OHS (mean±SD)	44±7.1	45±6.4	39±6.9	38±8.2
Post-op OHS (mean±SD)	18±4.8	19±6.4	16±4.1	16±5.9
Post-op interval (months) (mean±SD)	16±2.7	10±1.0	17±9.9	13±9.7

7.8 days, $P=0.001$). Overall there was a significant difference in mean post-operative stay between all routine physiotherapy patients and all intensive physiotherapy patients regardless of incision used (11.4 vs. 7.9 days, $P=0.003$).

There was no significant difference in the change in OHS between NHS and private patient groups ($P=0.12$; Table 2). Post-operative complications included four (4%) early dislocations, three (6%) in the minimal-incision groups and one (2%) in the standard-incision groups. Three dislocations occurred during the hospital stay, all underwent a successful closed reduced, and none dislocated a second time. Eleven patients in the minimal-incision/routine-physiotherapy group received prophylactic antibiotics compared to four in the standard-incision/routine-physiotherapy group. The antibiotics were given for prolonged wound ooze (more than 5 days); only one patient had a proven superficial infection, and there were no deep infections in any group. One patient in each of the standard- and mini-incision groups had a deep vein thrombosis.

Discussion

There is conflicting evidence regarding the effects of intensity of post-operative rehabilitation and minimal-incision surgery on the length of stay following hip replacement. In a randomised controlled trial by Munin and Rudy [12], 71 high-risk patients undergoing elective hip and knee arthroplasty underwent two different physiotherapy regimes. Patients began intensive in-patient rehabilitation on either post-operative day three or day seven. They showed that the mean total length of stay was shorter in the 3-day group than the 7-day group (11.7 vs. 14.5 days, $P<0.001$). Hughes and Kuffner [9] showed that introducing weekend physiotherapy services also significantly reduced length of stay in total hip arthroplasty (10.6 vs. 12.5 days, $P<0.05$). In contrast to these studies, Lang [11] showed that increasing routine post-op physiotherapy to 7 from 6 days a week made no difference in hospital stay.

Adequate surgical exposure and good visualisation of anatomical landmarks have always been taught early to surgeons in training. In total hip arthroplasty this has

traditionally meant incisions of up to 40 cm. Many surgeons believe that this amount of muscle and soft-tissue dissection contributes to a prolonged rehabilitation period. It would therefore seem logical that a reduction in incision length and dissection would lead to a reduction in length of stay. It is generally accepted that minimal-incision surgery is performed through an incision of 10 cm or less [18, 19], although some authors use a definition of up to 12 or even 13 cm [1, 3, 6]. This technique, in addition to reducing hospital stay, may also decrease blood loss, transfusion requirements and post-operative pain when compared to standard incisions.

Waldman [15] compared 30 patients undergoing a minimally invasive hip replacement with 91 patients undergoing a standard replacement using a direct lateral approach. He showed a reduction in mean hospital stay to 2.7 from 3.2 days. However, the minimally invasive patients had a mean age of 57 and a BMI of 27 compared with 73 and 31 respectively in the standard group. In contrast to this, Woolson et al. [18] showed that there was no significant difference in hospital stay between 50 patients undergoing a mini-incision and 85 a standard incision by a posterior approach. However, due to patient selection those undergoing a mini-incision had a lower BMI and fewer medical co-morbidities. Nevertheless, even with this patient selection the mini-incision did not have a significant effect on reducing length of stay but did lead to a higher rate of wound complications and component malposition. Wenz et al. [17] compared 65 standard-incision total hip replacements with 124 mini-incision total hip replacements. They showed that the mini-incision group had a significantly lower mean operation time, blood loss and transfusion requirements, but length of stay was not affected. Wright et al. [19] looked at 42 primary total hip arthroplasties performed through a mini-incision and compared them with a cohort of 42 patients with a standard incision. They found no significant difference in length of hospital stay (6.12 vs. 6.07 days).

This study suggests that intensive physiotherapy significantly reduces length of stay in primary total hip replacements, but the length of incision does not. It may be worthy of note, however, that in this series the standard incision averaged only 15.4 cm, and the deeper dissection included quadratus femoris but not an anterior capsulotomy. It may also be that excessive retraction on the surrounding skin and subcutaneous tissue causes a degree of trauma that detracts from the effects of less dissection. The increased use of prophylactic antibiotics in the mini-incision group for prolonged wound ooze would substantiate this.

Blood loss is thought to be directly related to the surgical exposure [3], but this was not shown in this study. This may be because skin incision and soft-tissue dissection is only one factor relating to blood loss; bleeding from bone will also have an important role. As the procedure in this study was similar once the skin incision had been made, overall blood loss may not significantly change. This accords with some studies [18, 19] but not others [13, 17].

Table 3 Post-operative stay and blood loss for the four patient groups

	Standard incision Routine physio	Minimal incision Routine physio	Standard incision Intensive physio	Minimal incision Intensive physio
Number	26	29	19	22
Post-op stay (days) (mean±SD)	11.9±4.3	10.9±5.1	7.9±2.4	7.8±1.9
Range (days)	7–23	7–28	5–12	5–11
Blood loss (drop in Hb) (mean±SD)	3.5±1.2	3.3±1.4	3.4±1.5	3.3±1.6

Patient physical and functional outcomes were assessed by using the OHS. There was a significant difference in the pre-operative OHS between all NHS patients and all private patients. This may be due to the delay of 9–12 months between listing to time of surgery for NHS patients and deteriorating symptoms of osteoarthritis. The change in the OHS post-operatively showed no significant difference, suggesting patient improvement and satisfaction to be the same in all groups.

The complications recorded in this study include dislocation, use of antibiotics, infections and thromboemboli. The rate of dislocation has been shown to be around 4% [14] for standard-incision surgery but is thought to be higher in mini-incision surgery due to the lack of exposure and increased risk of prosthesis malposition [2, 4, 15, 18]. Studies show dislocation rates from 0.8–2.6% for mini-incision surgery in some centres; however this does depend on the approach [1, 8, 10, 17]. In this study, the dislocation rate was 2% in the standard-incision group but 6% in the mini-incision group. This may demonstrate the learning curve involved in the new procedure, and surgeons must have a low threshold for enlarging the incision should they encounter difficulties. The senior author continually audits dislocations, and since this study, the dislocation rate using a mini posterior approach has been 1.7% over a 2-year period.

Deep infection is uncommon: Phillips and Barrett [14] showed that in a study of 58,521 patients undergoing primary THR the infection rate was 0.2%. Woolson et al. [18] showed that mini-incisions had a higher rate of wound complications than standard incisions (3 vs. 0%). This was indicated in this study by the increased use of prophylactic antibiotics in the mini-incision group; however, there were no deep infections at 12 months post-op.

Conclusion

This study suggests that in a standard UK setting, intensive physiotherapy can significantly reduce in-patient stay but minimal-incision surgery itself does not. The higher dislocation rate in the mini-incision group reflects the learning curve for this technique.

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