The Journal of Arthroplasty xxx (2016) 1–5

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Original Article

Driving After Microinvasive Total Hip Arthroplasty

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ARTICLE INFO

Article history:
Received 9 September 2016
Received in revised form
20 November 2016
Accepted 29 November 2016
Available online xxx

Keywords:
total hip arthroplasty
minimally invasive surgical procedures
postoperative period
automobile driving
brake reaction time

ABSTRACT

Background: Patients undergoing total hip arthroplasty (THA) are often advised to avoid driving for 6 weeks postoperation. This is based on patients having to maintain postoperative hip precautions and studies investigating brake reaction time (BRT) following THA using conventional techniques. The aim of this study was to assess patients' ability to drive in the early postoperative period following microinvasive THA by assessing BRT.

Methods: Hundred consecutive patients undergoing SuperPATH® THA in 2015 who drove automobiles preoperatively were included in this prospective cohort study. BRT was measured preoperatively and at day 1 or 2 postoperation using a driving simulator. A subset of 25 consecutive patients had repeat BRT testing at 2 weeks postoperation. Five BRT measures were taken at each time point. Differences in the patient's mean and best BRT at each time point were assessed using the paired t-test.

Results: The study cohort included 50 men and 50 women with mean age 63 years (range 25-86). The mean preoperative BRT was 0.63 s (range 0.43-1.44), with a mean difference of −0.1 s (range −0.57 to 0.33, $P < .0001$) at day 1 or 2 postoperation. The 2-week mean and best BRTs were also better than paired preoperative readings with a mean improvement of 0.15 s (range −0.78 to −0.004, $P < .0001$).

Conclusion: BRT reaches preoperative values by day 2 following microinvasive THA. Patients may be suitable to drive earlier than the previously recommended 6 weeks postoperation.

Total hip arthroplasty (THA) is a widely performed procedure that has excellent results in alleviating pain and recovering function [1,2]. Patients' functional recovery includes returning to work and sports over a period of months postsurgery [3,4]. Newer minimally invasive methods of THA hold the potential to accelerate this recovery period and allow patients to return to desired activities in shorter time frames. Driving is one of the most important aspects of daily life that patients are eager to return to postoperatively. The treating physician or surgeon is often looked to for guidance on appropriateness to get behind the wheel by both patients [5,6] and driving authorities [7]. Recent reviews consistently highlight the lack of clear clinical and legal guidelines on the appropriate time to return to driving after THA [5,6,8]. Current recommendations include advising patients against driving for up to 6 weeks post all THAs [9] or right-sided THA [10]. These recommendations are based on traditional approaches of THA that require patients to maintain hip precautions for up to 6 weeks to avoid dislocation, and studies reporting time to normalization of brake reaction times (BRTs) following these traditional approaches [11-14]. A more recent study showed that BRTs normalize by 2 weeks post right-sided THA using a muscle sparing approach [15]. The authors are not aware of any other studies investigating the time to return to driving after minimally invasive THA. The purpose of this study was to assess the ability to drive in relation to BRT in the early postoperative period following microinvasive THA using the novel SuperPATH® technique [16,17].

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2016.11.052.

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http://dx.doi.org/10.1016/j.arth.2016.11.052
0883-5403/

Materials and Methods

Patients and Setting

All patients undergoing SuperPATH THA by a single surgeon across 2 hospitals in Sydney, Australia in 2015 were eligible to participate in this prospective cohort study. No patients eligible for THA were excluded from the operative technique or the study on the basis of their age, body mass index (BMI), hip pathology, or medical comorbidities. Nondrivers and patients who had their THA performed using the traditional posterior approach were excluded from the study.

All patients were treated with the same operative technique, perioperative care, and rehabilitation protocol (with no hip precautions required).

Surgical Procedure

All operations were performed using the recommended SuperPATH technique [16,17]. Uncemented acetabular and femoral components with metal or ceramic on polyethylene bearing surfaces were implanted.

Study Variables and Measurement

Baseline patient characteristics including age, sex, BMI, hip pathology, and operative side were recorded. The primary study endpoint was difference in mean BRT preoperation vs day 1 or 2 postoperation.

BRT was measured using simulation software connected to a steering wheel and accelerator/brake pedals (Vericom Stationary Reaction Timer, Rogers, MN). Patients were given time to get used to simulator with practice runs. Once they felt adequately prepared, 5 sequential simulations requiring a hard brake (75%-100% brake pedal depression) were performed. Braking stimuli were randomly delayed between 1 and 10 s from starting with car speed at braking stimuli varied between 5 and 80 miles/h (8-129 km/h). Preoperative BRT was measured on the day of surgery. Postoperative BRT was measured once on either day 1 or day 2 postoperatively. Patients' best and mean of 5 results were recorded at each time point. The mean BRT value was chosen as the primary endpoint to reduce intraindividual variation as a source of random error. Difference in the best brake time recorded at each time point was assessed as a secondary endpoint.

A subset of consecutive patients had their BRT measurements repeated at the 2-week postoperative checkup using the same protocol. A further analysis was performed in this subset to compare differences in brake time before surgery, day 1 or 2 postoperation, and 2 weeks postoperation.

Statistical Analyses

Paired t-tests were used to compare preoperative and postoperative BRT. Generalized linear models were used to test for associations between difference in preop vs postop brake time and patient age, sex, BMI, hip side, and patient mean preoperative brake time. A mixed effects model for repeated measures that used all 5 brake times collected from each patient at preoperative and postoperative time point was also performed.

A sample of 100 patients was chosen for this study to provide 80% power to detect a difference of at least 0.1 s in BRT between preoperative and postoperative assessments, overall, and in relevant subgroups of patients of at least 20 patients (eg, to allow assessment of BRT difference by hip side). For these calculations, a paired t-test was used, the standard deviation for BRT was estimated at 0.15 s, and the type I error rate was set at 5%. Twenty-five consecutive patients were chosen for the 2-week repeat analysis as a convenience sample which would provide 90% power to detect a difference of 0.1 s in BRT under the same assumptions.

SAS 9.3 statistical software was used for these analyses. All statistical tests were 2-sided and a P value <.05 was considered statistically significant.

Human Research Ethics Approval was obtained from the Hunter New England Ethics committee (15/02/18/5.06).

Results

Hundred patients with a mean age of 63 years (range 25-86) were included. Half were men, and the majority had a BMI $\geq$ 25 kg/m^2 (Table 1). Underlying hip pathology was predominantly osteoarthritis (82%), followed by dysplasia (10%) and avascular necrosis (8%).

Six THA patients were excluded during the study. Of these, 3 patients underwent traditional posterior approach THA due to equipment unavailability and 1 patient was partially converted into a posterior approach due to difficult exposure during the operation. Further 2 patients were excluded as they did not drive. All patients had their postoperative BRT measurement on postoperative day 1-2 except for 1 patient who was assessed on postoperative day 4 due to logistical issues. No patients were lost to follow-up.

Mean BRT at baseline was 0.63 s (range 0.43-1.44). Mean difference in BRT from preop to day 1 or 2 postoperation showed improved BRT for both mean BRT 0.10 s (range −0.63 to 0.38, $P <$ .0001) and best BRT 0.07s (range −0.57 to 0.33, $P <$ .0001) (Table 2). Ninety-three (93%) patients achieved or improved on their mean preoperative brake time at their postoperative assessment on day 1 or 2 following surgery (Fig. 1). A similar proportion (92, 92%) achieved or improved on their best preoperative brake time at their best postoperative assessment (Fig. 2). We found similar results when all brake times for each patient at each time point were included in a repeated measures mixed effect model (mean difference 0.10 s).

Twenty-five consecutive patients (patient numbers 64-89 of overall cohort) underwent repeat BRT testing at 2-week follow-up appointment. All these patients' 2-week best and mean BRT were better than their preoperative results with a mean improvement for the group of 0.15 s (range −0.78 to −0.004, $P <$ .0001).

Table 1
Subject Baseline Characteristics.

Characteristic	*n* (%)
Age (y)	
<50	10 (10)
50-59	23 (23)
60-69	42 (42)
≥70	25 (25)
Mean (standard deviation)	62.9 (11.4)
Sex	
Male	50 (50)
Female	50 (50)
BMI (kg/m^2)	
20-24	25 (26)
25-29	35 (37)
≥30	35 (37)
Missing details	5
Mean (range)	28.9 (20.3-49.6)
Side of surgery	
Right	56 (56)
Left	44 (44)