The Effect of Navigator on Length of Stay and Rehabilitation for Total Hip Arthroplasty Patients

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Background: *Navigated THA is a new procedure in Thailand that has been performed since 2012. The previous studies have reported that navigated THA was a safe and reliable procedure that resulted in a more consistent cup placement compared to the conventional free hand technique. Furthermore, it decreased complications of THA, especially dislocation. Perioperative protocols are based on the surgeon's concern about stability of the prosthesis and the patient's health condition. Assuming that the navigator can improve the alignment and stability of THA, the time to start rehabilitation and the post-operative length of stay should be reduced in the hospital that does not implement any perioperative protocols. The purpose of the present study was to compare the time to start rehabilitation and the length of stay between navigated and non-navigated THA.*

Material and Method: *This retrospective study of patients underwent THA using short stem by a single surgeon between March 2011 and November 2012. Seventy-six patients were classified into navigated and non-navigated groups. The patient's characteristic data that were recorded included age, sex, BMI, comorbid illness, diagnosis, ASA classification, preoperative hematocrit, operative time, type of anesthesia, intraoperative blood transfusion, postoperative length of stay, postoperative complication, and time to start rehabilitation. The data were compared between two groups by t-test and Chi-square test.*

Results: *There were 41 patients in the navigated THA and 35 patients in the non-navigated THA. There were 35 male patients (85.37%) in the navigated group and 27 (77.14%) in the non-navigated group. The mean age was 44.17±11.39 years in the navigated group and 44.51±8.17 years in the non-navigated group. The mean BMI was 21.77±3.09 kg/m^2 in the navigated group and 22.44±4.3 kg/m^2 in the non-navigated group. Most of the patients were diagnosed with osteonecrosis (more than 85% in both groups). There were no significant differences between the demographic data of the two groups except the cup abduction and anteversion angle. The mean cup abduction angle in the navigated group was 41.37±2.01 degrees and 43.97±4.44 degrees in the non-navigated group (p-value <0.01). The mean cup anteversion angle in the navigated group was 13.57±3.28 degrees and 22.58±10.68 degrees in the non-navigated group (p-value <0.01). The mean number of days from operation to rehabilitation in the navigated group was 3.27±1.83 days and 4.34±1.33 days in the non-navigated group (p-value <0.01), which was significantly shorter. The postoperative length of stay was 5.37±2.42 days in the navigated group and 5.89±1.98 days in the non-navigated group. There were two patients with minor complications after operation. There was no dislocation or infection in both groups.*

Conclusion: *The navigated THA procedure resulted in a significantly shorter time to start rehabilitation. The postoperative length of stay was lower in the navigated group; however, it was not significant. The navigated THA technique increased the surgeon's confidence to provide early mobilization and rehabilitation program.*

Keywords: *Hip arthroplasty, Navigator, Rehabilitation, Length of stay*

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Hip arthroplasty is the standard treatment for patients with advanced hip diseases that are painful, limit function, and do not respond to conservative treatment. The number of patients admitted for total hip arthroplasty (THA) is increasing yearly. Current trends in THA have focused on perioperative care with the intent to provide quicker rehabilitation and shorter hospital stay[1-5]. Perioperative protocol is based on the surgeon's concern about stability of the prosthesis and the patient's health condition. Navigated THA is a new procedure in Thailand that has been performed since 2012. The previous studies have reported that navigated THA was a safe, reliable procedure that resulted in a more consistent cup placement compared

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to the conventional free hand technique and decreased complications of THA, especially dislocation[6-12].

Assuming that the navigator can improve the alignment and stability of THA, the time to start rehabilitation and the post-operative length of stay should be reduced in the hospital that does not implement any perioperative protocols. The purpose of this study was to compare the time to start rehabilitation and the length of stay between navigated and non-navigated THA.

Material and Method

This retrospective study was approved by the Ethics Committee of Maharat Nakhon Ratchasima Hospital. All patients operated using short stem cementless THA (Metha and Plasmacup SC; B. Braun Aesculap, Tuttlinggen, Germany) by a single experienced surgeon between March 2011 and November 2012 were included in the present study. The criteria for start rehabilitation were stable vital signs, no uncontrolled medical condition, no wound infection, adequate pain controlled, and can sit independently. The patients who did not receive any rehabilitation services were excluded from the study. Seventy-six patients were classified into navigated and non-navigated groups. The patient's characteristic data that were recorded included age, sex, BMI, comorbid illness, diagnosis, American Society of Anesthesiologists (ASA) classification, preoperative hematocrit, operative time, type of anesthesia, intraoperative blood transfusion, cup abduction, and anteversion angle from postoperative CT scan, post-operative length of stay, postoperative complication, and time to start rehabilitation[13,14]. The data were compared between two groups by t-test and Chi-square test with p-value was set at 0.05 for significant difference.

In surgical procedures in non-navigated group, all patients were performed in lateral decubitus position with modified Hardinge's approach. Cup orientation was aimed at 40°±5° of abduction and 15°±5° of anteversion. The operations were performed with manual technique in the non-navigated group.

In navigated group, the patients were positioned in semilateral decubitus with OrthoPilot THA plus 3.2 (cup only) software (Aesculap AG). A screw was inserted into the ipsilateral ASIS through a stab incision. The pelvic navigation tracker was attached to the screw. Bony landmarks (both ASIS and pubic symphysis) were determined and digitalized with a metal pointer to define anterior pelvic plane (APP). After removal of the femoral head, the deepest point of the acetabular fossa was registered as an additional reference point. Then, the trial cup was used to determine the natural abduction and anteversion of the acetabulum. The navigation showed the real-time information about the resulting position of the reamer (medialization, cranialization, and antero-poserior direction) and its orientation (abduction and anteversion) in relative to APP. After reaching the design reaming position, the final cup was put in place. The navigation showed the real-time information about the cup position and orientation. After finishing the cup, the femoral stem was inserted by conventional freehand technique as in the non-navigated group.

Results

There were 41 patients in the navigated THA and 35 patients in the non-navigated THA. The clinical characteristics of the patients were demonstrated in Table 1. There were 35 male patients (85.37%) in the navigated group and 27 (77.14%) in the non-navigated group. The mean age was 44.17±11.39 years in the navigated group and 44.51±8.17 years in the non-navigated group. The mean BMI was 21.77±3.09 kg/m^2 in the navigated group and 22.44±4.3 kg/m^2 in the non-navigated group. Most of the patients were diagnosed with osteonecrosis (more than 85% in both groups). Two patients (4.88%) in the navigated group and four patients (11.43%) in the non-navigated group had comorbid illness (1 DM, 1 renal insufficiency, 2 pulmonary comorbidity, and 2 steroid use for chronic condition). Sixty-five percent of the navigated group and 80% of the non-navigated group received spinal anesthesia. The mean preoperative hematocrit was 40.35±3.67% in the navigated group and 38.78±3.48 percent in the non-navigated group. Ninety percent of the navigated group and 97% of the non-navigated group were in ASA classification 1 and 2 and others were in ASA 3. Approximately 7% of the navigated group and 23% of the non-navigated group received intraoperative blood transfusion but did not reach statistical significance. The mean operative time was 108.9±23.12 minutes in the navigated group and 115.43±17.81 minutes in the non-navigated group. Twenty percent of the navigated group and 26% of the non-navigated group had a prolonged operative time of more than 120 minutes. There were no significant differences between the demographic data of the two groups except the cup abduction and anteversion angle. The mean cup abduction angle in the navigated group was 41.37±2.01 degrees and

43.97±4.44 degrees in the non-navigated group (p-value <0.01). The mean cup anteversion angle in the navigated group was 13.57±3.28 degrees and 22.58±10.68 degrees in the non-navigated group (p-value <0.01). The mean number of days from operation to rehabilitation in the navigated group was 3.27±1.83 days and 4.34±1.33 days in the non-navigated group (p-value <0.01), which was significantly shorter. The postoperative length of stay was 5.37±2.42 days in the navigated group and 5.89±1.98 days in the non-navigated group, which did not show significant difference. Two patients had minor complications after operation (urinary tract infection and infected arteriovenous fistula). There was no dislocation or infection in both study groups.

Discussion

Early rehabilitation after THA is not a new concept. The previous studies about 2-day length of stay program[1] and accelerated mobilization

Table 1. Clinical characteristics of the patient population

Characteristic	Total population, n (%) or mean ± SD		p-value
	Navigated THA	Non-navigated THA	
Number of patients	41	35	
Gender			
Male	35 (85.37%)	27 (77.14%)	0.357
Female	6 (14.63%)	8 (22.86%)	
Mean age, year	44.17±11.39	44.51±8.7	0.885
Mean BMI	21.77±3.09	22.44±4.3	0.518
Diagnosis			
Osteonecrosis	36 (87.8%)	30 (85.71%)	0.515
Post traumatic OA	4 (9.76%)	2 (5.71%)	
DDH	1 (2.44%)	3 (8.57%)	
Comorbidity			
DM	0	1 (2.86%)	0.276
Pulmonary	0	2 (5.71%)	0.121
Renal	0	1 (2.86%)	0.276
Steroids for chronic condition	2 (4.88%)	2 (5.71%)	0.871
ASA classes			
1	19 (46.34%)	23 (65.71%)	0.181
2	18 (43.9%)	11 (31.43%)	
3	4 (9.76%)	1 (2.86%)	
Anesthetic type			
General	14 (34.15%)	7 (20.00%)	0.202
Spinal	27 (65.85%)	28 (80.00%)	
Mean preoperative hematocrit (Hct)	40.35±3.67	38.78±3.48	0.060
Intraoperative blood transfusion	3 (7.32%)	8 (22.86%)	0.055
Mean operative time	108.90±23.12	115.43±17.81	0.178
Operative time >120 min	8 (19.51%)	9 (25.71%)	
Mean abduction and anteversion			
Mean abduction (range, SD)	41.37 (37-45, 2.01)	43.97 (33-52, 4.44)	<0.01*
Mean anteversion (range, SD)	13.57 (7-18, 3.28)	22.58 (2-39, 10.68)	<0.01*
Complications	1 (2.44%)	1 (2.86%)	0.363
Mean days from operation to start rehabilitation	3.27±1.83	4.34±1.33	<0.01*
Mean days from operation to discharge	5.37±2.42	5.89±1.98	0.314

* Statistic significant

THA = total hip arthroplasty; BMI = body mass index; OA = osteoarthritis; DDH = developmental dysphasia of the hip; DM = diabetes mellitus; ASA = American Society of Anesthesiologists

protocol[2] showed good results in decreased length of stay with low complications. When focus on rehabilitation or physical therapy, the results revealed that initiating physical therapy on day of surgery decreased length of stay without compromising functional outcomes compare to initiating physical therapy on post-operative day 1[3,4]. Munin et al[5] found that high-risk patients were able to tolerate early intensive rehabilitation (post-operative day 3) and had better results than post-operative day 7 in term of complications, cost, and faster attainment of short-term functional milestones.

In Maharat Nakhon Ratchasima Hospital, there was no implemented perioperative protocol for THA patients. The time to start rehabilitation depends on the surgeons. The navigated THA is a new surgical technique in Thailand that decreased postoperative complications especially dislocation. The aim of this study was to compare the time to start rehabilitation and the length of stay between navigated and non-navigated THA.

The present study demonstrated that the navigated THA took a significantly shorter time to start rehabilitation than the non-navigated THA. There were no significant differences between the demographic data of the two groups except the cup abduction and anteversion angle. This showed the surgeon's confidence from the navigator-assisted procedure that made the acetabular cup alignment more accurate and reduced the risk of postoperative dislocation. The previous studies showed that the accelerated protocols started rehabilitation bedside on the day of surgery[3,4] and ambulated at gym on day 2 or 3[3]. In Maharat Nakhon Ratchasima Hospital, there were exercises and ambulation with gait aid (axillary crutches or walker) at gym on the first day of the rehabilitation program. The surgeon made the decision about the proper time to start rehabilitation based on the patient's health condition and postoperative stability. From the results of the present study, the authors found that the patients started rehabilitation on day 3 in the navigated group and on day 4 in the non-navigated group, which is not a big difference compared to the other study. The navigated THA technique increased the surgeon's confidence to provide early mobilization and rehabilitation program. The patients in this study were in their forties, which is generally regarded as an active period of life. The patients could ambulate with gait aid and could be discharged from the hospital with only one or two rehabilitation sessions.

The limitations of the present study were small numbers of patients and retrospective study. Despite these limitations, the findings are of value because the present study includes patients treated by a single surgeon at a single institution using the same type of THA in all hips.

Conclusion

The navigated THA procedure resulted in a significantly shorter time to start rehabilitation. The postoperative length of stay was lower in the navigated group; however, it was not significant. The navigated THA technique increased the surgeon's confidence to provide early mobilization and rehabilitation program.

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What is already known on this topic?

Current trends in THA have focused on perioperative care with the intent to provide quicker rehabilitation and shorter hospital stay. The navigated THA is a new procedure in Thailand.

What this study add?

The navigated THA procedure resulted in a significantly shorter time to start rehabilitation. This technique increased the surgeon's confidence to provide early mobilization and rehabilitation program.

Potential conflicts of interest

None.

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ผลของการใช้คอมพิวเตอร์นำร่องต่อจำนวนวันนอนและการฟื้นฟูในผู้ป่วยผ่าตัดเปลี่ยนข้อสะโพกเทียม

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ภูมิหลัง: การใช้คอมพิวเตอร์นำร่องในการผ่าตัดเปลี่ยนข้อสะโพกเทียมเป็นการผ่าตัดวิธีใหม่ในประเทศไทย โดยเริ่มทำในปี พ.ศ. 2555 การศึกษาก่อนหน้านี้พบว่าการใช้คอมพิวเตอร์นำร่องเป็นวิธีที่ปลอดภัย ให้ผลการผ่าตัดที่ดีได้ตำแหน่งของเบ้าสะโพกเที่ยงตรงกว่าวิธีดั้งเดิมและลดภาวะแทรกซ้อนหลังผ่าตัดเปลี่ยนข้อสะโพกเทียม โดยเฉพาะอย่างยิ่งข้อสะโพกหลุด โปรแกรมการดูแลผู้ป่วยหลังผ่าตัดขึ้นกับการตัดสินใจของศัลยแพทย์เกี่ยวกับความมั่นคงของข้อสะโพกเทียมและอาการของผู้ป่วย ถ้าการใช้คอมพิวเตอร์นำร่องช่วยให้ตำแหน่งและความมั่นคงของข้อสะโพกเทียมดีขึ้นน่าจะส่งผลถึงการเริ่มโปรแกรมการฟื้นฟูได้เร็ว และลดวันนอนในโรงพยาบาลที่ยังไม่ได้มีการกำหนดแนวทางที่ชัดเจน จุดประสงค์ของการศึกษานี้คือเปรียบเทียบเวลาเริ่มการฟื้นฟูและจำนวนวันนอนในผู้ป่วยที่ผ่าตัดเปลี่ยนข้อสะโพกเทียมที่ใช้และไม่ใช้คอมพิวเตอร์นำร่อง

วัสดุและวิธีการ: ศึกษาแบบย้อนหลังในผู้ป่วยผ่าตัดเปลี่ยนข้อสะโพกเทียมแบบก้านสั้นโดยศัลยแพทย์คนเดียว ตั้งแต่เดือนมีนาคม พ.ศ. 2554 ถึง เดือนพฤศจิกายน พ.ศ. 2555 ผู้ป่วย 76 ราย ถูกแบ่งเป็น 2 กลุ่ม คือใช้และไม่ใช้คอมพิวเตอร์นำร่อง เก็บข้อมูลผู้ป่วยได้แก่ อายุ เพศ ดัชนีมวลกาย ประวัติโรคประจำตัว การวินิจฉัย ASA classification ความเข้มข้นเลือด เวลาในการผ่าตัด ชนิดของการระงับความรู้สึก การให้เลือดระหว่างผ่าตัด มุมกางและมุมเปิดหน้าเฉลี่ยของเบ้าสะโพกเทียม วันนอนหลังผ่าตัด ภาวะแทรกซ้อนหลังผ่าตัด และระยะเวลาเริ่มการฟื้นฟู เปรียบเทียบข้อมูลระหว่าง 2 กลุ่มโดยใช้ t-test และ Chi-square test

ผลการศึกษา: มีผู้ป่วย 41 ราย ในกลุ่มใช้คอมพิวเตอร์นำร่อง และ 35 ราย ในกลุ่มไม่ใช้คอมพิวเตอร์นำร่อง เพศชาย 35 ราย (85.37%) ในกลุ่มใช้คอมพิวเตอร์นำร่อง และ 27 ราย (77.14%) ในกลุ่มไม่ใช้คอมพิวเตอร์นำร่อง อายุเฉลี่ย 44.17±11.39 ปี ในกลุ่มใช้คอมพิวเตอร์นำร่อง และ 44.51±8.17 ปี ในกลุ่มไม่ใช้คอมพิวเตอร์นำร่อง ดัชนีมวลกาย 21.77±3.09 kg/m^2 ในกลุ่มใช้คอมพิวเตอร์นำร่อง และ 22.44±4.3 kg/m^2 ในกลุ่มไม่ใช้คอมพิวเตอร์นำร่อง ผู้ป่วยเกือบทั้งหมดได้รับการวินิจฉัยเป็นโรคหัวกระดูกฟีเมอร์ตาย (มากกว่า 85% ในทั้ง 2 กลุ่ม) ข้อมูลทั่วไปของผู้ป่วยทั้งสองกลุ่มไม่มีความแตกต่างกันอย่างมีนัยสำคัญยกเว้นมุมกางและมุมเปิดหน้าของเบ้าสะโพกเทียม มุมกางของเบ้าสะโพกเทียมเฉลี่ย 41.37±2.01 องศา ในกลุ่มใช้คอมพิวเตอร์นำร่อง และ 43.97±4.44 องศา ในกลุ่มไม่ใช้คอมพิวเตอร์นำร่องมุมเปิดหน้าเฉลี่ยของเบ้าสะโพกเทียม 13.57±3.28 องศา ในกลุ่มใช้คอมพิวเตอร์นำร่อง และ 22.58±10.68 องศา ในกลุ่มไม่ใช้คอมพิวเตอร์นำร่อง (p-value <0.01) จำนวนวันเริ่มการฟื้นฟูเฉลี่ย 3.27±1.83 วัน ในกลุ่มใช้คอมพิวเตอร์นำร่องและ 4.34±1.33 วัน ในกลุ่มไม่ใช้คอมพิวเตอร์นำร่อง ซึ่งมีความแตกต่างอย่างมีนัยสำคัญทางสถิติ (p-value <0.01) วันนอนเฉลี่ย 5.37±2.42 วัน ในกลุ่มใช้คอมพิวเตอร์นำร่องและ 5.89±1.98 วัน ในกลุ่มไม่ใช้คอมพิวเตอร์นำร่อง มีผู้ป่วย 2 รายมีภาวะแทรกซ้อนไม่รุนแรงหลังผ่าตัด ไม่พบข้อสะโพกหลุดหรือติดเชื้อ

สรุป: การผ่าตัดเปลี่ยนข้อสะโพกเทียมโดยใช้คอมพิวเตอร์นำร่องช่วยลดระยะเวลาการเริ่มโปรแกรมการฟื้นฟู ส่วนจำนวนวันนอนในกลุ่มใช้คอมพิวเตอร์นำร่องน้อยกว่าแต่ไม่แตกต่างอย่างมีนัยสำคัญทางสถิติ การใช้คอมพิวเตอร์นำร่องในการผ่าตัดเปลี่ยนข้อสะโพกเทียมช่วยเพิ่มความมั่นใจให้ศัลยแพทย์ในการให้ผู้ป่วยเริ่มการเคลื่อนไหว และเข้าโปรแกรมการฟื้นฟูได้เร็ว