The Early Outcome of Birmingham Hip Resurfacing: An independent Thai Surgeon Experiences

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Background: *Modern metal-on-metal total hip resurfacing show improvement outcome as a viable alternative arthroplasty in the young, but in Thailand it remains controversial whether this procedure is appropriate by Thai surgeon. Some in doubt this procedure may need high technical demand and may not valuable in Thailand.*

Objective: *To analyze the early clinical and radiographic outcomes of Birmingham Hip Resurfacing (BHR) by Thai surgeon in Thailand.*

Material and Method: *Between January 2006 and December 2008, thirty-eight patients (forty hips) who were operated with BHR by same surgeon. The authors evaluated Harris Hip score, Oxford hip score, University of California Los Angeles (UCLA) activity score, Short form-12 score, and complications as well as radiographic alignment and radiolucencies.*

Results: *At a mean follow up of 16.2 months (3 to 33). The mean pre-operative and last follow up Harris Hip score were 35.1 (27 to 41) and 96.4 (95 to 98) ($p < 0.001$) respectively. The mean Oxford hip score were 44.3 (37 to 52) and 12.4 (11 to 13) ($p < 0.001$) respectively. The mean UCLA activity score was 3.4 (3 to 4) and 8.8 (8 to 10) ($p < 0.001$) respectively. The mean SF12 were 18.2 (14 to 23) and 62.2 (59 to 64) ($p < 0.001$) respectively. There was no patient with radiological evidence of loosening or thinning of the femoral neck. Four cases had intra-operative transient blood pressure drop while impacting metal cup into circumference sealed acetabulum. However, no subsequence post operative complication was detected. There was one case with pulmonary embolism in secondary osteonecrosis from sickle cell anemia and resolve without any complication. One case with fracture neck of femur due to osteochondroma removal at anterosuperior head neck junction which exposure too much cancellous bone. She had got successfully conversion to metal on metal total hip replacement with post operative excellent result. There was no infection, deep vein thrombosis and nerve injury. The survival rate was 97.5%.*

Conclusion: *As femoral head bone preservation procedure, BHR in this study provides excellent and promise result. Longer study is needed to address more complications. The authors are support the use of BHR in young active patient in Thailand.*

Keywords: *Outcome, Birmingham hip resurfacing, Osteoarthritis, Surgical procedures*

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The conventional total hip arthroplasty (THA) which remove entire femoral head is very successful in older and sedentary but not in young active patients.[1-3] The common and specific hip diseases in younger Thai patient such as osteonecrosis, developmental hip dysplasia (DDH), secondary osteoarthritis (OA), are interfering their quality of life and keep them away from current occupation, sport activities and finally they are social burden. The conventional THA are not last long and cannot bring them back to normal lifestyle entire the rest of life and trend to gain more trouble when they get older. As younger Patient expectations have also risen, and want to return to normal levels of functions, including sporting activity. After many failure in first generation of hip resurfacing

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and metal-on-metal hip replacement[4-6], new combination concept of metal-on-metal hip resurfacing design (second generation) has been an attractive option in United Kingdom from 1991, reborn of metal on metal articulation and normal hip diameter make solutions in extremely low wear, more stable hip and also restore normal biomechanics of the hip joint producing[7-9] very high long term survival rates[10-13]. Conversion to total hip replacement can be done without difficulty and same complication rate with primary total hip replacement[14].

In 2002, The author (VL.) had got hip and knee fellowship training from Mr. Stephen J McMahon, Melbourne Orthopaedic Consultant Monash Medical University Australia. He is also specializing in Birmingham Hip Resurfacing (BHR, Smith & Nephew, Birmingham, United Kingdom) which began this procedure from 1999. BHR has been the most popular hip resurfacing in Australia from the beginning until now[15]. As the third generation of metal on metal bearing, BHR is the original and most successful of modern metal on metal total hip resurfacing arthroplasty. Data from the Australian National Joint Replacement Registry show that BHR was the most popular, best longevity and least complication in 2008[15]. The survival and functional results were encouraging and suggested that this implant would be well suited for use in patients with young active and higher demands[12].

In Thailand, BHR was imported start from January 2006 and then the first implantation was performed by VL. The authors report the outcome and functional results of an independent series of 40 BHRs which include early cases in learning curve.

Material and Method

All patients who underwent BHR at both public and private hospitals between January 2006 and December 2008 were included in this study. This study comprise of 38 patients with 40 BHRs. Of these, 18 were women and 20 men, with a total of 22 right-sided BHRs and 16 left-side BHRs. Demographic data was shown in Table 1 below. The mean age at operation was 41.3 years (24 to 59). Both patients who had bilateral procedures were two staged operation with one and three months apart respectively. OA and osteonecrosis were major diagnosis leading to resurfacing (Table 2).

The outcome measures were the Oxford hip score (OHS)[16], Harris hip score (HHS)[17], University of California Los Angeles (UCLA) activity scale[18] and patient satisfaction by SF12.

Table 1. Demographics data

Parameters	Values (mean)
Patients	38
Thai	21
Arabian	10
Caucasian	7
Male:Female	23:15
Hips	40
Age (years) (mean)	43.7 (19-60)
Left:Right	25:15
Height (cm) (mean)	168 (152-185)
Weight (kg) (mean)	60.5 (49-95)
BMI (kg/m^2) (mean)	25.5 (21.6-29.8)

Table 2. Etiologies

Causes	Number
Osteonecrosis	21
Stage IIB*	1
Stage III	7
Stage IV	13
Osteoarthritis	14
DDH Crowe II	1
DDH Crowe II + Familial multiple exostosis	1
Post trauma	2
Ankylosis spondylitis	1

* Combine necrotic angle = 290 degrees

An anteroposterior (AP) radiograph of the pelvis was used to calculate the positioning of the implant as well as to identify the presence of heterotopic bone formation, as described by Brooker[19]. The stem-shaft angle and acetabular inclination were measured as described by Beaule[20], which defines the stem-shaft angle as the angle between the stem and the anatomical axis of the femoral shaft, and the acetabular inclination angle as the angle between a line across the face of the acetabular component and the inter-teardrop line. Thinning of the femoral neck at the head neck junction was defined by post operative decreasing ratio of metal head-neck junction diameter and the distance from the superior margin of the lesser trochanter to inferior neck of metal head. If the calculation reduction is less than 10%, thinning was diagnosed[13].

Operative techniques and post-operative management

Pre-operative radiographic template for estimating proper size both cup and head, mild valgus

femoral stem orientation were planned then stem tip was measured from just above lesser trochanter with 15% pre-magnified template ruler. Cup planning was set to 40 degrees lateral opening. All patients underwent a standard pre- and post-operative regimen. One gram cefazoline was administered intraveneously at induction for prophylaxis, and then two more day dose with 1 gram every 6 hours then oral antibiotic was continue. With the patient in the lateral position and under spinal epidural anesthesia or spinal anesthesia, an extended posterior approach to the hip joint was incised as described by McMinn[21]. Tensor fascia lata was split then Charnley's retractor was applied. The short external rotators were released, the gluteus maximus was the gluteus maximus was partially detached detached from its insertion at the linea aspera, and a complete circumferential capsulotomy was performed step by step. The femoral neck was measured to two nearest head sizes which available for 2-4 acetabular sizes would be chosen later. The femoral head was then dislocated anterio-superiorly and the acetabulum reamed sequentially. The trial cup component was measure until 1 mm diameter smaller than the intended final implant was used. The real acetabular component was then impacted with double spikes were orientation to pubic bone and ischium respectively.

Acetabular osteophytectomy was done until less than 1 mm rest. Short arm jig type of Birmingham instrumentation was used to align and position the guide rod for the preparation of the femoral head using pinning point that measure from pre-operative template. Circular checking with orbitting stylus was performed, superior notching was avoided. The proper thickness blue stopper was used to protect unexpected cylinder ream protrude to trochanteric bone area which prevent chance to fracture later. The head was reamed step by step to accept a femoral component that matched the implanted acetabular component. Expanded cone shape stem drill was finally reamed. The lesser trochanter suction vent was inserted. Macro cement locking drills were done at many points in cancellous bone surface on femoral head.

The femoral implant was positioned and secured with Simplex (Howmedica International, Limerick, Ireland) low-viscosity cement at within one and a half minutes. The hip was then reduced and then posterior capsule, the short external rotators, gluteus maximus tendon, tensor fascia lata were repaired step by step. Haemoglobin levels were checked on the first postoperative day and an AP radiograph of the pelvis was obtained. Ambulation and mobilization was allowed on the second post-operative day by immediate full weight-bearing with axillaries crutches or walker gait aids as tolerated. Patients were discharged home when they were able to mobilize independently.

Patients were reviewed at six weeks, three, six, twelve months post-operation when a further AP radiograph of the pelvis was obtained and then annually visit. About statistical analysis the changes in the pre-operation and last follow-up hip scores were compared for statistical significance using the Pair T-test. A p-value < 0.05 was considered significant.

Results

Among 38 patients, Twenty one were Thai, 7 were Caucasian and 10 were Arabian. The most common cause was osteonecrosis, 70%. Eighty percents of cause for surgery in Thai was osteonecrosis. The mean length of stay in hospital was 5.83 days (5 to 9). The mean follow-up was 16.2 months (3 to 33).

There was one case with osteonecrosis Stage IIB with 290 degrees of combine necrotic angle was performed BHR. He had experience with contra lateral hip osteonecrosis Stage IIB and then failure to simple core decompression in which finally was reoperation to bipolar arthroplasty by other surgeon. So he refused to try core decompression and want to do any single operation. Double setup for BHR/MoM THA was prepared and after all necrotic bone was ream out by resurfacing procedure, BHR was finally performed.

The mean OHS pre-operatively was 44 (37 to 52) and at final post-operative review was 12.4 (11 to 13), which was a statistically significant change ($p < 0.001$). The mean UCLA activity score improved from a mean of 3.4 (3 to 4) pre-operatively to 8.8 (8 to 10) postoperatively ($p < 0.001$). The preoperative mean HHS was 35 (27-41) and at last follow-up was 96.4 (95 to 98) ($p < 0.001$). The mean SF 12 was increased from a mean of 18 (14 to 23) pre-operatively to 62.2 (59 to 64) postoperatively ($p < 0.001$).

The mean femoral stem-shaft angle was 140.3° (130° to 159°), with a mean acetabular inclination angle of 40.8° (35° to 50°). Thinning of the femoral neck was none at final review. Heterotrophic ossification was none. No radiolucent lines both femoral and acetabular components.

Four cases had encounter transients blood pressure drop while inserting metal cup into seal acetabulum, The air entrapped between metal and well reamed acetabulum were pump into cancellous bone of acetabulum then air and bone marrow fat emboli were

Table 3. Summary results

Parameters	Values (mean)
Follow-up (months)	16.2 (3-33)
Cup angle	40.8° (35-50)
Stem-shaft angle	140.3° (130-159)
Length of stay (days)	5.83 (5-9)
Blood loss (cc)	683 (380-1020)
Operative time (min)	115 (95-145)
Incision length (cm)	18.4 (16-22)
Radiographic osteolysis	0
Radiographic polar gap cup	1 (2.5%)
Radiographic neck thinning	0
Complications	
Clincial DVT	0
PE	1 (2.5%)
Death	0
Nerve injury	0
Infection	0
Neck fracture[#]	1 (2.5%)
Intra-operative BP drop[$]	4 (10%)
Dislocation	0

[#] Underlying DDH and familial multiple osteochondroma
[$] Transient blood pressure drop while insert metal cup

Table 4. Functional scores

	Pre-operation	Last follow-up
HHS	35.0 SD 5.62 (27-41)	96.4 SD 1.32 (95-98)
Oxford	44.0 SD 5.23 (37-52)	12.4 SD 1.12 (11-13)
UCLA	3.4 SD 0.66 (3-4)	8.8 SD 1.13 (8-10)
SF12	18.0 SD 3.11 (14-23)	62.2 SD 1.89 (59-64)

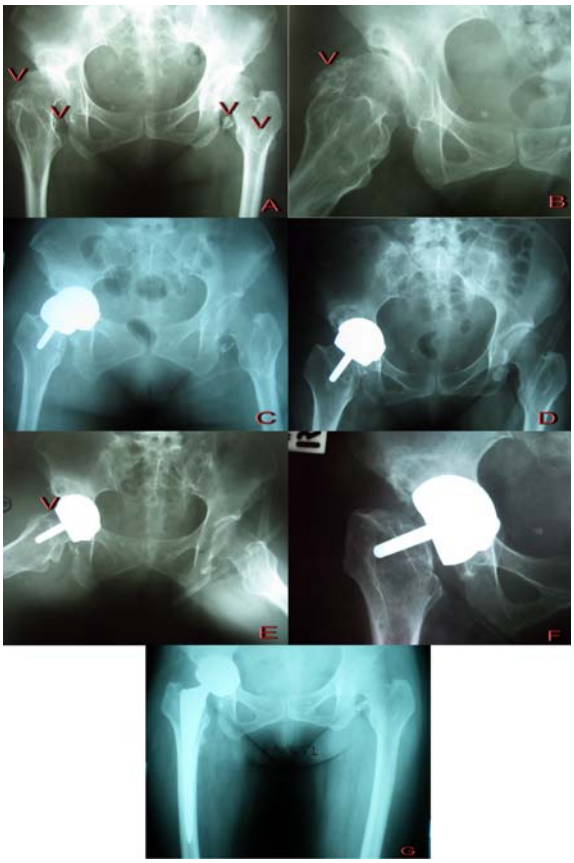

Fig. 1 A, B Thai 43-year old female develop secondary osteoarthritis right hip from DDH Crowe II, underlying familial multiple exostosis especially at anterosuperior head neck junction of right femur. In C, Immediate post-op X-ray before end of anesthetic effect show subluxation from inadequate soft tissue tension due to medializatoin of metal cup and uncorrectable lateral head offset. Next day in D, after muscle tone came back, head was reduced, however broken Shenton's line still occur. In E, Anterosuperior cancellous expose because removal exostosis and very thin cortex at this area. In F, she was advice to protect weight on her right leg for 3 months, a few days after start weight on left leg, fracture neck happened. Successfully conversion to metal-on-metal total hip arthroplasty was performed. She was then went back to work with normal quality of life

throw into blood circulation and heart chambers[22]. Due to all patients were younger than 60 years old without any history of cardiologic problems, this temporally complication was not fatal result. Blood pressure was then return to normal within few minutes.

One acetabular polar gap was happen in post operative X-ray. After 6 months, the gap was completely filled with cancellous bone. No pain or further complication for this phenomenon.

There was one fracture of the femoral neck then convert to MoM THA. She had underlying DDH Crowe II and congenital familial osteochondroma. Her right hip has developed osteoarthritis and progressive painful hip for 1 year before surgery. Before surgery, high risk of fracture neck and other mode of failure were discussed and finally she decided to take all risk for BHR. After surgery, she was recommended to protect her weight with axillaries crutches and toe touch walking for 3 months. One week after she has got allow to start full weight bearing with axillaries crutches, severe hip groin pain happen without major

trauma. Fracture neck was diagnosis and then conversion procedure was done without any difficulty. Next day after conversion, she was allowed to full weight bearing with crutches and go back to work after 4 weeks.

Another 25-year-old Arabian patient has dyspnea at night, the same day after discharge from hospital. He had underlying sickle cell anemia and later developed to bilateral osteonecrosis stage III. On the operative day, after spinal block he had got delay operation for 2 hours due to accidentally urethra rupture from catheterization. One hundred minutes was utilized for BHR without any difficulty but total anesthetic period was 4 hours. He had got deep vein thrombosis prophylaxis by low molecular weight heparin and then warfarin. He was re-admitted at the same night that discharged then pulmonary embolism was diagnosed and got treatment by internal medicine doctor. Then he was allowed to physical therapy again without any more subsequence complication. The causes were combination of prolong anesthesia and underlying sickle cell anemia.

Discussion

This is the first independent BHR experience report from Southeast Asia. Treacy[12] reported a five-year survival rate of 98%, and Daniel[23] reported a revision rate of 0.02% in their series at a mean follow-up of 3.3 years. The survival rate in this series is 97.5% at mean follow-up 16.2 months. During learning curve of intra-operative decision making produced subsequence fracture neck femur at 3 months after operation. Surgical techniques and exposures were not too difficult to operate if surgeons follow exactly steps as describe in cadaveric workshop. Both McMinn short arm and long arm jig femoral head alignment guide are extremely accurate, no need to use computer navigator for assisting proper alignment. There is no complication related to posterior approach despite historical concern[24].

This study had some limitations. The mean follow-up time was 16.2 months. There is no radiographic thinning of the femoral neck more than 10% in this series which previous papers report from 14.5% to 77%[13,25]. However no adverse clinical consequences from this thinning of the femoral neck were found after duration of up to six years. There are two main reasons. The first is trying to sink cup beneath acetabular border within 1 mm and remove osteophyte around cup. The rest reason that may be more important is the follow-up time is not long enough to address this problem.

By femoral head retrieval analysis, the failure case show that the cause of fracture neck was not from subsequence osteonecrosis. Femoral stem angle was 152 degrees that appropriate for BHR. The exactly cause of fracture neck was intra-operative produce weaken point at superior part of head-neck junction. Although bone quality in this case was above range of osteopenia, this cancellous bone exposure occurred after osteochondroma removal and then was the main cause of fracture neck due to micro-fracture propagation from that weak point.

The author usually set abduction cup angle to 40-45 degrees which there is strong evidence that reduce metal ion production and decrease wear debris. Result of mean acetabular inclination was 40.8°. Similar to Beaule et al report a mean inclination angle of 41.8° in their article[10]. To prevent abnormal high cup abduction angle, the author strongly recommend to use offset cup introducer especially in cases that prefer to operate with shorter incision length.

Conclusion

This study shows excellent early result. The author realize that BHR is another excellent bone preserving solution and provide predictable result for hip disease in high demand, young, active patient both male and female. According to long history of metal on metal hip arthroplasty by McKee Farrar and Peter Ring, this prosthesis expect to be last long up to or more than 30 years and postpone total hip replacement to elderly period with same blood loss and complication rate with primary total hip arthroplasty, not revision total hip arthroplasty[14].

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ผลสำเร็จของการรักษาผิวข้อสะโพกเทียมโดยแพทย์ไทย

วิโรจน์ ลาภไพบูลย์พงศ์, ธนา ธุระเจน, พฤทธิพันธ์ แพรกทอง

ภูมิหลัง: *ผลสำเร็จของการผ่าตัดเปลี่ยนผิวสะโพกเทียมสมัยใหม่ซึ่งมีรายงานกันทั่วโลก แสดงให้เห็นถึงคุณูปการในการรักษาข้อสะโพกในวัยทำงาน ในประเทศไทยยังไม่มีความมั่นใจที่จะนำเอาการรักษาด้วยวิธีนี้มาใช้ด้วยความไม่มั่นใจถึงผลสำเร็จในการรักษา การผ่าตัดที่มีรายงานมาก่อนว่ายุ่งยาก และถูกมองข้ามว่าไม่มีคุณค่าในประเทศไทย*

วัตถุประสงค์: *เพื่อวิเคราะห์ผลสำเร็จของการรักษาโดยการผ่าตัดผิวสะโพกเทียมด้วยผิวข้อสะโพกเทียมเบอร์มิงแฮม ซึ่งทำการผ่าตัดโดยแพทย์ไทย ในประเทศไทย*

วัสดุและวิธีการ: *เก็บรวบรวมข้อมูลตั้งแต่ มกราคม พ.ศ. 2549 จนถึงธันวาคม พ.ศ. 2551 ผู้ป่วยจำนวน 38 คน (40 ข้อสะโพก) ได้รับการผ่าตัดรักษาด้วยผิวสะโพกเทียมเบอร์มิงแฮมโดยแพทย์คนเดียวกัน คณะผู้วิจัยได้เก็บผลประเมินค่า แฮร์รีฮิบสกอร์ อ๊อคฟอร์ดฮิบสกอร์ ยูซีแอลเอสกอร์ แบบสอบถามอย่างสั้น 12 ข้อ รวมถึงภาวะแทรกซ้อนและผลการวัดภาพถ่ายทางรังสี*

ผลการศึกษา: *ค่าแฮร์รีฮิบสกอร์ ก่อนผ่าตัดได้ค่าเฉลี่ย 35.1 (27 ถึง 41) หลังผ่าตัดได้ค่าเฉลี่ย 96.4 (95 ถึง 98) แตกต่างอย่างมีนัยสำคัญ ระดับ $p < 0.001$, ค่าอ๊อคฟอร์ดฮิบสกอร์ก่อนผ่าตัดได้ค่าเฉลี่ย 44.3 (37 ถึง 52) หลังผ่าตัดได้ค่าเฉลี่ย 12.4 (11 ถึง13) แตกต่างอย่างมีนัยสำคัญ ระดับ $p < 0.001$, ยูซีแอลเอสกอร์ก่อนผ่าตัดได้ค่าเฉลี่ย 3.4 (3 ถึง 4) หลังผ่าตัดได้ค่าเฉลี่ย 8.8 (8 ถึง 10) แตกต่างอย่างมีนัยสำคัญ ระดับ $p < 0.001$ และ แบบสอบถามอย่างสั้น 12 ข้อ ก่อนผ่าตัดได้ค่าเฉลี่ย 18.2 (14 ถึง 23) หลังผ่าตัดได้ค่าเฉลี่ย 62.2 (59 ถึง 64) แตกต่างอย่างมีนัยสำคัญ ระดับ $p < 0.001$ ไม่พบว่ามีผู้ป่วยรายใดที่มีภาพถ่ายทางรังสีผิดปกติหลังผ่าตัด ไม่ว่าจะเป็นภาวะการหลุดหลวมหรือ กระดูกส่วนคอสะโพกแคบลง มีผู้ป่วย 4 ราย ประสบปัญหาความดันโลหิตตกระหว่างการใส่เบ้าสะโพกเทียม แต่ไม่พบปัญหาต่อเนื่องใด ๆ ตามมา มีผู้ป่วยเป็น Pulmonary embolism หลังผ่าตัดหนึ่งรายเนื่องจากเป็นผู้ป่วยที่มีปัญหาของข้อสะโพกขาดเลือด ที่เป็นผลมาจากความผิดปกติของโรคเลือดแต่กำเนิด ที่เรียกว่าเม็ดเลือดแดงรูปกระสวย กับผู้ป่วยหญิงอีกรายหนึ่งที่กระดูกบริเวณคอสะโพกหักหลังผ่าตัด อันเป็นผลมาจากคุณภาพของกระดูกที่บริเวณส่วนบนค่อนมาด้านหน้าไม่ดีกลายเป็นจุดอ่อนที่นำไปสู่การหักได้ง่าย ซึ่งจุดอ่อนนี้เป็นผลมาจากการตัดกระดูกงอกบริเวณนั้นออก ผลการผ่าตัดแก้ไขเปลี่ยนเป็นข้อสะโพกเทียมแบบทั่วไปชนิดโลหะชนกับโลหะได้ผลการรักษาที่ดี ผู้ป่วยพึงพอใจมาก ในรายงานนี้ไม่พบภาวะติดเชื้อลิ่มเลือดในเส้นเลือดดำ รวมถึงการบาดเจ็บของเส้นประสาทใกล้ข้อสะโพกเลย อัตราการอยู่รอดของข้อสะโพกเทียมเบอร์มิงแฮมอยู่ที่ 97.5%*

สรุป: *ข้อดีของการผ่าตัดเปลี่ยนผิวสะโพกเบอร์มิงแฮม นอกจากจะช่วยให้ไม่ตัดหัวสะโพกออกแล้วยังให้ผลการรักษาที่ดีเยี่ยม อย่างไรก็ตามยังต้องติดตามการรักษาไปอีกสักระยะหนึ่ง เพื่อให้แน่ใจว่าไม่ปัญหาอื่น ๆ ตามมาอีกในระยะกลางและยาว จากผลการศึกษาเป็นผลสำเร็จในการรักษาโดยแพทย์ไทยในประเทศไทย ชี้ให้เห็นว่าประสิทธิผลในการรักษานี้ตอบสนองความต้องการในวัยทำงานเป็นอย่างดี สมควรมีการสนับสนุนให้มีการผ่าตัดเป็นอีกทางเลือกหนึ่งในประเทศไทย*