Eklem Hastalıkları ve Cerrahisi
Joint Diseases and Related Surgery

Technical Note / *Teknik Not*

Joint Dis Rel Surg
2008; 19(3):148-149

Vacuum test in hip hemiarthroplasty

Kalça parsiyel protez ameliyatlarında vakum testi

Volkan Öztuna, Mehmet Çolak, Aziz Vurucu, Cengiz Yılmaz

Mersin University School of Medicine, Department of Orthopaedics
Mersin, Turkey

Objective

Size of prosthetic head for hip hemiarthroplasty operations has been estimated by measuring the femoral head by a caliper intraoperatively. In addition, surgeons test the trial heads in the acetabulum by a maneuver of reduction and dislocation. Than, they take a decision on the head size according to the sense of vacuum between the socket and the trial head (the so called "vacuum test"). In this study, we examined the reliability of this subjective test.

Patients and methods

In a series of fifteen hemiarthroplasty operations of the hip for femoral neck fractures, two orthopaedic surgeons conducted the vacuum test independently to estimate the correct size of the femoral head diameter.

Results

Interclass correlation was significant between the measurements made by two surgeons (95% CI: 0.83-0.98; p=0,015).

Discussion

The vacuum test can be used safely to take the final decision on the size of the prosthetic femoral head in hemiarthroplasty operations.

Key words: Hip arthroplasty, prothesis, femoral head, diameter, vacuum test

Amaç

Parsiyel kalça protezi ameliyatlarında kullanılacak olan protezin baş büyüklüğüne ameliyat sırasında çıkartılan femur başının çapının cetvelle ölçülmesi ile karar verilir. Buna ek olarak, protezin deneme başının asetabulum içine sokulması ve çıkartılması sırasında oluşan eksi basınç hissi ("vakum testi" olarak adlandırılmıştır.) baş ve asetabulum büyüklüğünün uyumu konusunda karar verme kriteri olarak kullanılmaktadır. Bu çalışmada subjektif bir test olan vakum testinin güvenilirliği araştırılmıştır.

Hastalar ve yöntem

Femur boyun kırığı olan 15 hastanın parsiyel protez ameliyatları sırasında birbirinden bağımsız olarak iki cerrah vakum testi gerçekleştirerek uygun femur başı çapını belirlediler.

Bulgular

İki cerrahın ölçümleri arasında interklas korelasyon değerlendirmesi anlamlı oranda uyumlu çıktı (95% CI: 0,83-0,98; p=0,0154).

Çıkarımlar

Vakum testi, parsiyel kalça protezi ameliyatları sırasında protez başının büyüklüğünü saptamak için kullanılabilecek güvenilir bir yöntemdir.

Anahtar sözcükler: Kalça artroplastisi, protez, femur başı, çap, vakum testi

• *Received: August 03, 2007* *Accepted: January 28, 2008*

• *Correspondence:* Volkan Oztuna M.D. • Viransehir Mah, Moda Plaza, C Blok D:10 Mersin, 33189, Turkey
• Tel: +90-324-3374300/1161 • Fax: +90-324-3374305 • e-mail: oztuna67@mersin.edu.tr

In hemiarthroplasty operations of the hip, a congruous artificial joint needs perfect fit of the prosthetic head into the acetabulum. Size of the prosthetic head has been estimated by measuring the preoperative radiographs and the size of the removed femoral head intraoperatively by a caliper or a special template.[1,2] Traditionally, surgeons test the trial head in the acetabulum by a reduction and dislocation maneuver. During this test, the sense of negative pressure between the head and acetabulum and even the sound during the maneuver (the so called "vacuum test") is considered to assess the congruency. To our knowledge the reliability of this subjective test has not been proved. We examined the reliability of the vacuum test in this study.

PATIENTS AND METHODS

In a series of fifteen hemiarthroplasty operations of the hip for femoral neck fractures, two orthopaedic surgeons; one of them having an experience over 300 operations and the other having performed only a few hip hemiarthroplasties, to estimated the correct femoral head size by assessing the vacuum sense and the sound that was heard during the dislocation and the relocation of the trial head. The first surgeon began the surgery by an anterior exposure. Capsulotomy was made through the labrum. Two pieces of the capsule were held by forceps. The femoral head was extracted. Then he tested the trial heads in the acetabulum with 1 mm increments beginning with the smallest size (40 mm) and made a final decision according to the sense of negative pressure (vacuum) between the socket and the trial head and to the sound that was heard during the dislocation and relocation maneuvers. After his decision, the second surgeon scrubbed in, made the same test independently and estimated the size of the femoral head. Finally the original femoral head was measured by a compass and all three values were recorded (Table 1).

Tablo 1. Estimations and measurements of the femoral head.

	Caliper	Surgeon 1	Surgeon 2
Case 1	50	50	50
Case 2	46	46	46
Case 3	48	47	48
Case 4	45	45	45
Case 5	44	44	44
Case 6	45	45	45
Case 7	48	48	48
Case 8	50	50	50
Case 9	46	45	46
Case 10	50	50	50
Case 11	44	44	45
Case 12	52	52	52
Case 13	46	45	46
Case 14	46	46	46
Case 15	54	54	54

RESULTS

Interclass correlation was significant between the measurements made by the two surgeons (95% CI: 0,83-0,98; p=0,0154). Strong correlation was found between all three measurements (p= 0,0001).

DISCUSSION

The reliability of the vacuum test in hemiarthroplasty operations of the hip was proved in this study and it does not depend on the experience of the examiner. There is no objective and measurable values for the vacuum test. So it should not be used solely. This subjective test may be adjunctive in determining the head size, especially when the caliper measurement is in between the two numeric values (eg. 44mm - 45mm). The study was not designed to reveal the test's value on determination of prosthetic survival. The long-term follow up of this study was, therefore, not included.

During hemiarthroplasty operations of the hip, a perfect fit of the prosthetic head into the acetabulum should be obtained to prevent deterioration of the normal contact between the head and the socket. If the head of the prosthesis is smaller than the premorbid femoral head, a polar type of contact will occur. Consequently the stress on the remaining load-bearing cartilage will increase and erosion of the acetabular cartilage will result in migration and degenerative changes. When the prosthetic head is too large, an equatorial type of contact will occur. This mismatching will result in restricted and painful motion of the hip.[3,4] Thus, the correct matching of the prosthetic head and the socket is crucial. In cases of prior operations and deformations of the femoral head and comminuted fractures, it may not be possible to measure the femoral head size correctly by a caliper or a template. In such cases, the vacuum test is the only reliable method to make a decision on the head size of the prosthesis.

The vacuum test can be used safely as a supplementary test to make a final decision on the size of the prosthetic femoral head in hemiarthroplasty operations.

REFERENCES

1. Baumgaertner MR, Higgins TF. Femoral neck fractures. In: Bucholz RW, Heckman JD, eds. Fractures in Adults. Philadelphia: Lippincott Williams&Wilkins; 2001. p. 1578
2. James W Harkess. Arthroplasty of Hip. In: Canale ST, editor Campbell's Operative Orthopaedics. St Louis: Mosby; 1998. p. 296.
3. Radin E. Biomechanics of the human hip. Clin Orthop Relat Res. 1980;152:28-34.
4. Salvati AE, Artz T, Aglietti P, Asnis SE. Endoprostheses in the treatment of femoral neck fractures. Orthop Clin North Am. 1974;5:757-77.