

OTTO PELVIS REMODELING AFTER TOTAL HIP ARTHROPLASTY

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ABSTRACT

Objective: To check the acetabular remodeling through the methods described by Sotelo-Garza and Charnley, as well as the Köhler Line or ilio-ischiatic line on patients submitted to total hip arthroplasty with threaded cup CO-10. **Results:** Concerning the classification by Sotelo-Garza and Charnley, preoperatively, we had 6 patients on group I (mild) and 14 patients on group II (moderate), not classifying any patient with severe acetabular protrusion or above 15 mm. Postoperatively, group I was constituted of 17 patients, and only 3 on group II, with group III remaining with no patients included. The patient who presented the best acetabular remodeling was the one with the longest follow-up

time (10 years), reducing 9 mm by the LK method and 5 mm by Sotelo-Garza and Charnley's method. **Materials and Methods:** 20 cases of Otto pelvis patients treated between 1996 and 2005 submitted to total hip arthroplasty with threaded cup CO-10 were retrospectively described. We checked for acetabular remodeling through the methods by Sotelo-Garza and Charnley and Köhler or ilio-ischiatic line. **Conclusion:** We found a significant acetabular remodeling with the proposed treatment approach, which advocates the use of non-cemented prosthesis for equatorial acetabular support for treating Otto pelvis.

Keywords: *Acetabulum/pathology. Acetabulum/surgery. Arthroplasty replacement hip. Bone remodeling.*

Citation: Campos JPE, Schwartsmann CR, Faria M, Bernabé AC, Gomes M, Luca Junior G. Otto pelvis remodeling after total hip arthroplasty. *Acta Ortop Bras.* [online]. 2009; 17(1):58-61. Available from URL: <http://www.scielo.br/aob>.

INTRODUCTION

Acetabular protrusion, first described by Otto¹, is characterized by a deformity on acetabular medial wall with progressive migration of femoral head into pelvis, causing mechanical disorders, pain and major functional restraint of the hip joint.

Its treatment is still very controversial. In early cases, osteotomies may be a good indication, but in later cases, literature seems to agree that the best indication is surgical treatment with total hip prosthesis. Using cemented or non-cemented prostheses, the use of bone grafts at the bottom of the acetabulum also seems to be a consensus. However, non-cemented prostheses with equatorial threaded acetabular support, with little or no effort transfer on the bottom of the acetabulum, additionally to stabilize hip joint, seem to act by reducing Otto pelvis.

Thus, from these data, we hereby aimed to check acetabular remodeling of hips submitted to total arthroplasty with threaded CO-10 acetabulum for treating Otto pelvis.

MATERIALS AND METHODS

Twenty cases of patients with acetabular protrusion treated between 1996 and 2005 and submitted to total hip arthroplasty with

threaded cup CO-10, being 6 men and 14 women, mean age: 57.8 years. For this analysis, X-ray images of the pelvis were pre- and postoperatively taken at anteroposterior (AP) plane, with a mean follow-up time of 4 years (+/- 2.7 years). Acetabular protrusion degree measurement was made by using the method described by Sotelo-Garza and Charnley (C)² and by the method of Köhler line (KL) or ilioischiatic line.³ The previous uses the distance from a line projected as an extension of the upper edge of the pubic branch up to the edge of the real pelvis. (Figure 1) The second method consists of measuring the distance from KL up to the acetabulum medial edge wall. (Figure 2) We compared pre- and postoperative measurements, classifying them as according to Sotelo-Garza e Charnley² as mild when 1-5 mm, moderate when 6-15 mm, and severe when above 15 mm, thus checking acetabular remodeling in millimeters. For this, we firstly explored data intending to assure a symmetrical distribution of results, and then we used the statistical t test for dependent samples, considering that each group was assessed at two different moments, before and after the proposed intervention. In all situations, we adopted a significance level of 5%. The statistical program adopted in this investigation was the "SPSS for windows" (release 13.0).

All authors state no potential conflict of interest concerning this article

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Received in 11/06/07 approved in 07/18/08

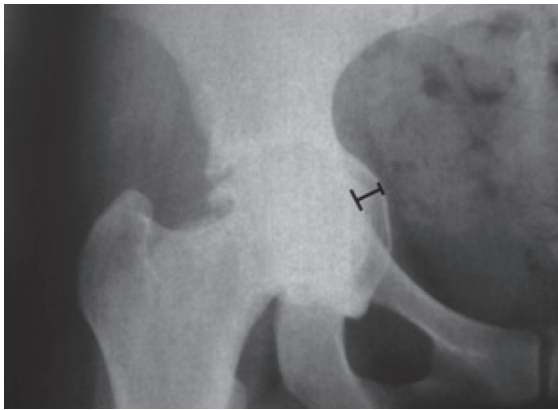


Figure 1 - Method by Sotelo-Garza and Charnley.

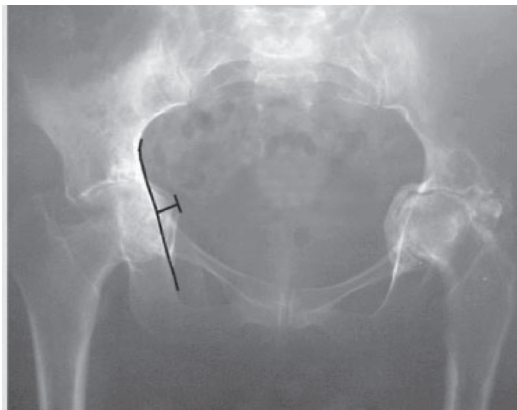


Figure 2 - Köhler Line method

RESULTS

By exploring data, we observed a phenomenon that should be considered. We evidenced the presence of a severe outlier case in the postoperative group assessed by the KL method (which uses the Köhler line). In this sense, intending to assure a better symmetrical distribution of the results, we chose to exclude it from the sample.

The significance level associated to the test on correlations in both cases was $p = 0.000$, with a correlation of 0.83 for method C and 0.78 for method KL. These values evidence the existence of a strong positive linear association between scores obtained in both moments in both groups. From this, considering that high correlation, the use of the proposed statistical test could be justified.

Concerning the classification by Sotelo-Garza and Charnley, in the preoperative period, we had 6 patients included on group I (mild), and 14 patients in group II (moderate), with no patient being classified as with severe acetabular protrusion or above 15 mm. Postoperatively, group I had 17 patients, and only 3 on group II, with group III remaining with no patients included. The patient showing the highest level of acetabular remodeling was the one with the longest follow-up time (10 years), being reduced by 9 mm by the KL method, and 5 mm by the method of Sotelo-Garza and Charnley.²

Table 1 and Figure 3 show the description of the results for both groups. Then, we provide examples on figures 4, 5 and 6 of pre- and postoperative X-ray images evidencing major acetabular remodeling.

Table 1 - Descriptions of the results, considering the suggested measurements

MEASUREMENT METHODS	n	Intervention	Mean (S.D.)	S.E.M.	p
METHOD C	19	Preoperative	6.79 (3.19)	0.73	0,000
		Postoperative	4.05 (2.74)	0.63	
METHOD KL	20	Preoperative	11.35 (4.43)	0.99	0,001
		Postoperative	8.85 (3.92)	0.88	

S.E.M. - Standard Error of the Mean.

- Measures in mm

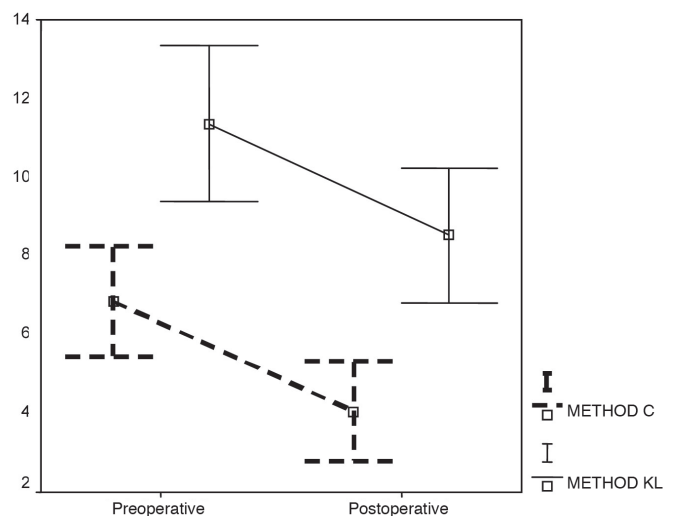


Figure 3 - Behavior of both groups

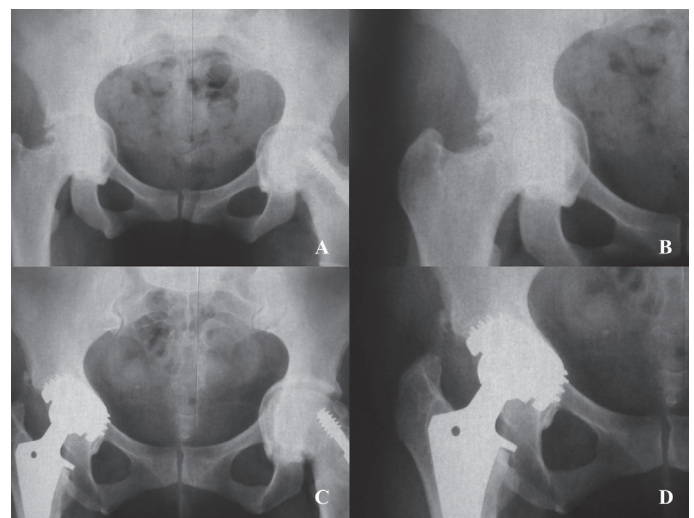


Figure 4 - X-ray images at AP plane and focused on the right hip of a patient with bilateral Otto pelvis treated with total hip arthroplasty (THA), non-cemented, with threaded cup CO-10, right. A - Preoperative hip X-ray image. B - Focused preoperative X-ray image. C - Postoperative hip X-ray image. D - Focused postoperative X-ray image evidencing clear acetabular remodeling.

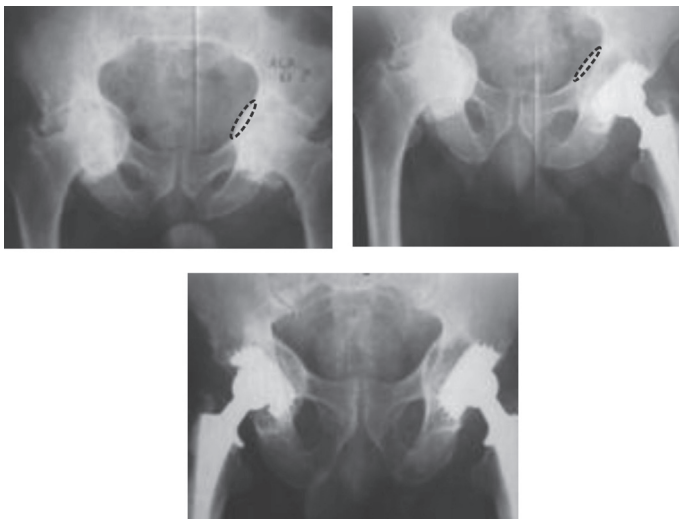


Figure 5 – X-ray images showing 10-year evolution of a patient with bilateral Otto pelvis treated with THA CO-10-type bilaterally. A – Preoperative hip X-ray image. B – Postoperative hip X-ray image (left). C – Postoperative hip X-ray image (bilateral).

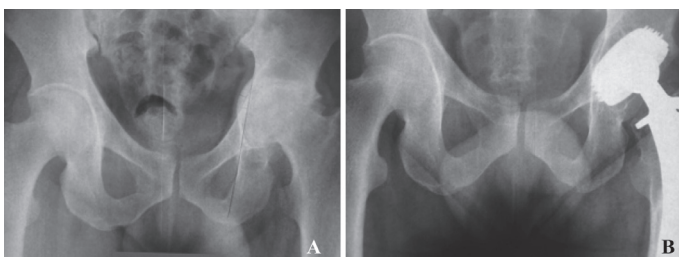


Figure 6 – Acetabular remodeling after THA CO-10-type in a patient with Otto pelvis (left). A – Preoperative hip X-ray image. B – Postoperative hip X-ray image.

DISCUSSION

Acetabular protrusion was first described by Otto¹ in 1824, from studies conducted in cadavers, being characterized by deformity of medial acetabular wall with progressive migration of femoral head into the pelvis.

The etiopathogenesis of acetabular protrusion is regarded as multifactorial, suspected to present a familial trend.³ It can be idiopathic or secondary to conditions such as rheumatoid arthritis, Paget's disease, infections, etc. Sotelo-Garza and Charnley², in a study conducted on 182 patients, found 75.3% of primary etiology, and 24.7% of secondary etiology. However, other authors such as McCollum et al.⁴ report in their articles primary acetabular protrusion as extremely rare, occurring in a very small percentage of cases. If left untreated, this condition tends to evolve with progressive protrusion, with the great trochanter reaching acetabular edge.⁵ Diagnosis is mainly based on radiologic measurements obtained from pelvic X-ray images at anteroposterior plane, which not only enable us to identify, but also grade protrusion. These measurements are obtained from methods using, in most times, anatomical references on X-ray tests.

Some simpler methods serve only for detecting protrusion, and not for grading it: tear sign inversion, increased Wiberg angle, Shenton line discontinuity.³ Others, as the one by Sotelo-Garza and Charnley,² measuring the distance from real pelvis edge to a

projected line extending the upper edge of pubic branch, allow us to grade it according to the above-mentioned authors as mild, moderate and severe.

Gates et al.⁶ assessed 12 kinds of pre- and postoperative X-ray measurements to quantify acetabular protrusion in patients treated with total hip arthroplasty and medial acetabular support with bone grafting. Their results show that the method using the Köhler line may be useful, although measurements can vary according to some pelvic obliquity degrees. The method shown to be more effective was the one using a system of coordinates x and y based on tears. The authors emphasize this method's ability to check acetabular protrusion at horizontal and vertical planes, and they assess tears as a quite constant parameter on X-ray examinations. However, the authors mention that this method can be impaired in some cases when the visualization of the tear is impossible on the X-ray image.

Due to the uncommon nature of Otto pelvis in the general population, there are few studies in literature describing long follow-up times for better investigating the best and most effective treatment method for this pathology. Nevertheless, the surgical indication of total hip arthroplasty and autologous or homologous bone grafting aimed to provide further support to medial acetabular wall, to restore femoral head's rotation center and to preserve hip joint's range of motion, seems to be a consensus among authors.⁷ Most articles point out to the use of spherical cemented prostheses and autologous femoral head grafts.^{4,7,8} Despite of the questionable and disappointing results of straight threaded prostheses⁹⁻¹¹, several papers highlight the fixation of threaded prostheses covered with hydroxyapatite.¹²⁻¹⁴

Sharp et al.¹⁵ call attention for the use of non-cemented prosthesis with equatorial acetabular support. The authors show in their article that these models are able to restore hip stability by reducing protrusion and providing a more accessible future review, if necessary. The explanation for this trend to solve the defect on the medial acetabular wall consists of changing the orientation of the resulting force, which represents load support on hip joint caused by equatorial support prostheses. Thus, in cases of medial failure, the indication of a threaded acetabular component is recommended, because, in theory, all support and fixation is provided on acetabular edges, not requiring force transfer on the bottom of the acetabulum. This fact allows for a better integration of the graft, forces distribution and the potential remodeling to a more anatomical pattern.

Based on the results previously described hereon, we also found that acetabular remodeling in cases of protrusion treated with non-cemented equatorial support prostheses is significant. The analysis of reported data allow us to notice a statistically significant difference both in the group of cases assessed by the method of Sotelo-Garza and Charnley¹ and in those in which the Köhler line method was employed,³ considering pre- and postoperative measurements. Data suggest that, regardless of both measurement techniques proposed here, a similar behavior is seen at both moments studied.

CONCLUSION

By assessing 20 Otto pelvis cases, with 14 grade II and 6 grade I cases according to the classification by Sotelo-Garza and Charnley, treated with total hip arthroplasty with CO-10, we conclude that, after a mean follow-up time of 4 years (+/- 2.7), we obtained a statistically significant acetabular remodeling with both measurement methods proposed.

REFERENCES

1. Otto AW. Seltene Biobachtungen zur anatomie: Physiologie und pathologie gehorig. 2nd ed. Berlin: Rucker; 1824.
2. Sotelo-Garza A, Charnley J. The results of Charnley arthroplasty of the hip performed for protrusio acetabuli. *Clin Orthop Relat Res.* 1978;132:12-8.
3. Chueire AG, Rejailli WA, Santos AF. Protrusão acetabular (Otopelve). *Acta Ortop Bras.* 2002;10:52-7.
4. McCollum DE, Nunley JA, Harrelson JM. Bone-grafting in total hip replacement for acetabular protrusion. *J Bone Joint Surg Am.* 1980;62:1065-73.
5. Pomeranz MM. Intrapelvic protrusion of the acetabulum (Otto pelvis). *J Bone Joint Surg Am.* 1932;14:663-86.
6. Gates HS, Poletti SC, Callaghan JJ, McCollum DE. Radiographic measurements in protrusio acetabuli. *J Arthroplasty.* 1989;4:347-51.
7. SlooffTJJH, Huiskes R, Horn JV, Lemmens AJ. Bone-Grafting in total hip replacement for acetabular protrusion. *Acta Orthop Scand.* 1984;55:593-6.
8. Hirst P, Esser M, Murphy JCM, Hardinge K. Bone Grafting for protrusio acetabuli during total hip replacement. *J Bone Joint Surg Br.* 1987;69:229-33.
9. Shaw JA, Bailey JH, Bruno A, Greer RB 3rd. Threaded acetabular components for primary and revision total hip arthroplasty. *J Arthroplasty.* 1990;5:201-15.
10. Fox GM, McBeath AA, Heiner JP. Hip replacement with threaded acetabular cup. *J Bone Joint Surg Am.* 1994;76:195-201.
11. Simank HG, Brocai DR, Reiser D, Thomsen M, Sabo D, Lukoscsek M. Middle-term results of threaded acetabular cups. High failure rates five years after surgery. *J Bone Joint Surg Br.* 1997;79:366-70.
12. Manley MT, Capello WN, D'Antonio JA, Edidin AA, Geesink RG. Fixation of acetabular cups without cement in total hip arthroplasty. A comparison of three different implants surface at a minimum duration of follow up of five years. *J Bone Joint Surg Am.* 1998;80:1175-85.
13. Epinette JA, Manley MT, D'Antonio JA, Edidin AA, Capello WN. A 10-year minimum follow-up of hydroxyapatite-coated thread cups. *J Arthroplasty.* 2003;18:140-8.
14. D'Antonio JA, Capello WN, Jaffe WL. Hydroxyapatite-coated hip implants. Multicenter three-year clinical and roetngenographic results. *Clin Orthop Relat Res.* 1992;285:102-15.
15. Sharp DJ, Porter KM, Duke RFN. The resolution of protrusio acetabuli treated with ring's hip prosthesis. *J Bone Joint Surg Br.* 1984;66:635-8.