

Percutaneous versus open epiphysiodesis

Adnan G. Alzahrani, MD, JBOS, Yaser M. Behairy, MD, FRCSC, Mohammad H. Alhossan, MD, FACHARTZ, Faisal S. Arab, MD, FACHARTZ, Abdulaziz A. Alammari, MD, FRCSC.

ABSTRACT

Objective: Epiphysiodesis is used for the treatment of leg-length discrepancy in skeletally immature patients. Pnemister described an open technique that requires surgical dissection with potential morbidity. Recently, minimally invasive approaches that utilize intraoperative fluoroscopy have been introduced. The aim of this study is to compare our experience using the open and the minimally invasive percutaneous techniques.

Methods: A prospective follow-up of 87 consecutive patients undergoing epiphysiodesis for correction of post traumatic leg-length discrepancy using either the open or the percutaneous technique at the Armed Forces Hospital, Riyadh, Kingdom of Saudi Arabia between January 1993 and December 2000.

Results: Out of the 87 patients, 52 were carried out using

the open technique and 35 were utilized by this percutaneous technique. There was no statistically significant difference between the 2 groups in terms of demographic data, operative time, perioperative complications or time required to achieve the growth arrest. However, there was a significant difference in the hospital stay and postoperative need for physiotherapy. The percutaneous group had a shorter hospitalization (average 2.5 days) compared to the open technique group (average 4 days).

Conclusion: Our experience is similar to what is reported in the literature and confirms that the percutaneous technique has an advantage over the open technique with shorter hospitalization and less duration of physiotherapy.

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Limb length discrepancy in the lower extremity may result from a variety of conditions that cause damage to the epiphyseal growth plate such as trauma, infections, tumors, radiation damage, or vascular anomalies. The resulting deformity may lead to cosmetic as well as functional impairment. Treatment of these deformities requires careful clinical and radiological assessment. Epiphysiodesis has been accepted as an effective treatment method for leg-length discrepancy and angular deformities in the skeletally immature patient.¹⁻⁴ When used for treating limb length discrepancy, it involves the timely arrest of the growth plate of the contralateral leg in order to achieve equal limb length by skeletal maturity. In dealing with angular deformities, the epiphysiodesis is carried out on the

convex side to allow progressive correction of the deformity with growth. Pnemister technique, described in 1910 has been most widely used for growth plate arrest.⁵ This is an open technique that requires surgical dissection with the potential morbidity. More recent techniques for epiphysiodesis involve the use of a minimally invasive percutaneous approach with the utilization of intraoperative fluoroscopy.⁶⁻⁹ In this report we present our experience using the open and the minimally invasive percutaneous techniques.

Methods. Included in this study are patients who were surgically treated for leg-length discrepancy in the Armed Forces Hospital, Riyadh, Kingdom of Saudi Arabia in

From the Department of Surgery (Alzahrani, Alhossan, Arab), Armed Forces Hospital and the Department of Surgery (Behairy, Alammari), King Fahad National Guard Hospital, Riyadh, Kingdom of Saudi Arabia.

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Address correspondence and reprint request to: Dr. Yaser Behairy, PO Box 53118, Riyadh 11583, Kingdom of Saudi Arabia. Tel. +966 (1) 2520088 Ext. 4119. Fax. +966 (1) 2520088 Ext. 4138. E-mail: ybehairy@yahoo.com

the period between January 1993 and December 2000. Only patients with post-traumatic deformities requiring distal femoral or proximal tibial epiphysiodesis, or both were included in this report. All of these patients underwent epiphysiodesis for correction of their deformities using either the classic open technique or the minimally invasive percutaneous technique. Each patient underwent a detailed clinical examination preoperatively and on regular periods postoperatively. Scanograms of the lower limbs were obtained on each patient as part of the routine preoperative and postoperative follow-up. The Moseley straight-line graph was used as a base line for planning the surgery and for follow-up postoperatively.¹⁰ The first 52 patients in the study group were done using the open technique. In the remaining 35 patients, the percutaneous technique was utilized. An inflatable tourniquet was used in both techniques. The open technique utilizes a 3-5 centimeters skin incision followed by soft tissue dissection down to the edge of the growth plate. The edge of the growth plate is identified by direct vision and confirmed by intraoperative plain radiographs. The growth plate is excised under direct vision and the wound is closed in a routine fashion. In the minimally invasive technique, the level of the growth plate is identified using the C-arm and intraoperative fluoroscopy. A one centimeter skin incision is centered at that level and a drill bit is used to make a hole in the cortex. Small curets were introduced through the hole and used to remove the growth plate under the guidance of the C-arm (**Figure 1**). In both techniques, a cylindrical cast is applied for postoperative immobilization for 4 weeks and the patient is allowed a full weight bearing on the operated leg. Physiotherapy for quadriceps strengthening exercises and knee range of motion was started after removal of the cast. Demographic data, perioperative complications, and the time until growth arrest was recorded in each patient. Growth arrest was judged clinically by lack of progression of the original deformity and by evidence of bridging bone on radiological examination.



Figure 1 - Percutaneous epiphysiodesis using intraoperative fluoroscopy.

continued growth of the physal plate. Postoperative complications occurred in 6 (11%) of the 52 patient who under went the open technique. Four of those were superficial wound infections and 2 were hypertrophic scars. In the group who under went the percutaneous technique, 4 patients (11%) developed superficial wound infections. There was no neurological or vascular complications in either group of patients. Full postoperative knee range of motion was achieved in the minimally invasive group after 2 weeks of physiotherapy in 25 (72%) patients, and after 4 weeks of physiotherapy in the remaining 10 (28%). For the open technique, 31 patient (60%) had to undergo physiotherapy for 6 weeks, and the remaining 21 (40 %) for 4 weeks in order to get their full range of motion.

Results. A total of 87 patients were included in this study. In 52 (60 %) patients who underwent the open technique for epiphysiodesis, 30 were males and 22 were females. Their average age at the time of surgery was 12.3 years (range 10-14). In the remaining 35 patients who underwent the percutaneous technique for epiphysiodesis, 16 were males and 19 were females. Their average age at the time of surgery was 12.8 years (range 10 -14). There was no statistically significant difference in the average operative time between the two groups. In the open technique, it was 75 minutes and in the percutaneous technique it was 67 minutes. The average hospital stay was 4 days (range 1-8) in the open technique and 2.5 days (range 1-5) in the percutaneous technique. Growth arrest was achieved in all 87 patients at an average period of 4 months (range 3-6). There was no statistically significant difference between the 2 groups. No patient had failure of the growth arrest or

Discussion. Significant leg-length discrepancy in the skeletally immature population can lead to significant functional impairment. Over the long term, it can lead to abnormalities in gait, increase energy expenditure, compensatory scoliosis and back pain. Methods of dealing with leg-length discrepancy may include lengthening of the short leg or shortening of the long leg. Shortening can be achieved easily by arresting the growth plate at the appropriate time.¹¹ This, however, requires careful assessment of the chronological and skeletal age, the current and predicted limb length discrepancy and the predicted adult height. Growth arrest can be achieved by using either the classic open technique or the minimally invasive percutaneous technique. In this report, we found both techniques to be effective in achieving the arrest of the growth plate.

There was no statistically significant difference in the period required to achieve the arrest or in the perioperative complications. There was however, a significant difference in the duration of hospital stay and the postoperative need for physiotherapy. The percutaneous group had a shorter hospitalization (average 2.5 days) compared to the open technique group (average 4 days).

In conclusion, our experience is similar to what is reported in the literature and confirm the fact that the minimally invasive percutaneous technique for arresting the growth plate can achieve similar results to the phemister open technique with the added advantage of shorter hospitalization and less duration of physiotherapy.¹²

References

1. Green W, Anderson M. Epiphyseal arrest for the correction of discrepancies in the length of the lower extremity. *J Bone Joint Surg Am* 1957; 39: 853-872.
2. Hasler CC. Leg length inequality. Indications for treatment and importance of shortening procedures. *Orthopade* 2000; 29: 766-774.
3. Dahl MT. Limb length discrepancy. *Pediatr Clin North Am* 1996; 43: 849-865.
4. Canale ST, Christian CA. Techniques for epiphysiodesis about the knee. *Clin Orthop* 1990; 255: 81-85.
5. Phemister DB. Operative arrestment of longitudinal growth of bones in the treatment of deformities. *J Bone Joint Surg* 1933; 15: 1-15.
6. Bowen JR, Johnson WJ. Percutaneous epiphysiodesis. *Clin Orthop* 1984; 190: 170-173.
7. Ogilvie JW. Epiphysiodesis: evaluation of new technique. *J Pediatr Orthop* 1986; 6: 147-159.
8. Gladbach B, Pfeil J, Heijens E. Percutaneous epiphysiodesis. Correction of leg-length inequalities and frontal plane deformities. *Orthopade* 2000; 29: 2-8.
9. Atar D, Lehman WB, Grant AD, Strongwater A. Percutaneous epiphysiodesis. *J Bone Joint Surg Br* 1991; 73: 173-176
10. Moseley CF. A straight line graft for leg length Discrepancies. *Clin Orthop* 1978; 136: 33-40.
11. Porat S, Peyser A, Robin GC. Equalization of lower limbs by epiphysiodesis: results of treatment. *J Pediatr Orthop* 1991; 11: 442-448.
12. Scott AC, Urquhart BA, Cain TE. Percutaneous vs modified phemister epiphysiodesis of the lower extremity. *Orthopedics* 1997; 20: 300.