

Reducing learning period complications and increasing accuracy in periacetabular osteotomy. Surgical technique with navigated bone cuts and acetabular positioning.

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Keywords

Periacetabular osteotomy, PAO, Navigation, Surgical technique, Accuracy, Complications

ABSTRACT

Background

Shallow acetabulum with reduced femoral coverage is the hallmark for developmental dysplasia of the hip, which manifests clinically as regional pain, fast tiring, instability, and pathologically increased range of motion. It may be associated with symptoms and signs of labral pathology as well. Periacetabular osteotomy (PAO), which reorients the acetabulum, is the most etiological surgical treatment for pathologic acetabular orientation. It is a complex, technically demanding free-hand procedure with long learning curve, usually performed in high-volume hospitals by high skilled surgeons. To avoid learning-related complications, we developed a surgical technique with the use of electromagnetic navigation (EMN) system and patient specific templates, aiming to increase safety of the procedure, improving precision of the four osteotomies and accuracy of the position of reoriented acetabulum.

Objectives

The purpose of our study was to evaluate safety, reliability and accuracy of our EMN assisted acetabular reorientation compared to traditional x-ray only technique.

Design and Methods

We conducted a retrospective observational study with prospectively collected data on a series of 32 consecutive dysplastic hips, where all the patients were operated on using the modified Bernese PAO, upgraded with patient specific templates and our EMN system. In the first group (XR group) consisting of 10 patients, reorientation of the acetabulum was performed under x-ray control. In the second group (EMN group) consisting of 22 patients we introduced EMN controlled reorientation of the acetabulum during PAO. Missing medical data was retrieved from our electronic chart database and pelvic radiographs; follow-up (FU), age at the time of surgery, body-mass-index (BMI), surgery duration, perioperative blood loss, Harris Hip Score (HHS) and postsurgical complications. Lateral Center-Edge (LCE) angle and Acetabular Index (AI) were measured on last pre- and last postoperative anteroposterior pelvis radiograph

Results

Average FU was 0.74 ± 0.65 years for EMN group and 2.51 ± 1.07 years for XR group, average age was 31.67 ± 10.82 years for EMN group and 36.02 ± 13.48 for XR group and average BMI was 24.14 ± 3.12 for EMN group and 22.65 ± 2.90 for XR group. Average pre-surgical absolute difference of LCE from optimal 30° angle was 13.43 ± 9.80 for EMN group and 14.77 ± 7.31 for XR group. Average pre-surgical absolute difference of AI from optimal 0° angle was 13.85 ± 7.48 for EMN group and 18.18 ± 5.82 for XR group. No statistically significant differences in patients' characteristics (age, BMI) and pre-surgical parameters were found between the study groups. XR surgeries took 23.3 minutes longer (95% CI -1.1 to 47.6); $p < 0.05$ at $\alpha = 0.1$. We observed no significant differences in blood loss between the groups. EMN surgeries resulted in significantly lower absolute difference of LCE (mean 4.12, CI 0.6 to 7.6), EMN surgeries also achieved a lower absolute difference of AI (mean 1.48, 95% CI -1.56 to 4.52); $p < 0.05$ at $\alpha = 0.1$. There were no statistically significant differences in HHS between groups. In the XR group we noted one transient peroneal palsy and one pulmonary embolism while no major complications were observed in the EMN group.

Conclusion

This study indicates improved accuracy, safety and reliability of using patient specific templates and EMN systems in PAO, with short learning curve. Furthermore, with the use of EMN technique, we achieved better and reproducible acetabular position compared to the traditional x-ray controlled technique.