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Is There a Limit to Lengthening in Patients Who Have Crowe IV Developmental Dysplasia of the Hip Undergoing Total Hip Arthroplasty?

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Is there a limit to lengthening in patients who have Crowe IV developmental dysplasia of the hip undergoing total hip arthroplasty?

Response/Recommendation: A review of the current literature does not identify a specific limit to acute limb lengthening in patients undergoing total hip arthroplasty. The traditional limits, such as 4 cm, are based on older studies with some methodological deficiencies. With careful intraoperative monitoring, restoration of length may be considered in selected cases.

Level of Evidence: Limited.

Delegate Vote: Agree: 83%, Disagree: 11%, and Abstain: 5% (Superior Majority, Strong Consensus).

Rationale

A search was conducted for all studies investigating the outcomes of total hip arthroplasty (THA) for hip arthritis secondary to Crowe III to IV developmental dysplasia of the hip, aiming to define a safe acute lengthening limit. The search encompassed the following electronic databases: PubMed: 865 results on May 28, 2024; Central: 33 results on April 26, 2024; and Embase: 835 results on May 14, 2024. After the removal of duplicates and exclusion of noneligible studies following the screening of the title and abstract, 419 studies were eligible for full-text evaluation. Finally, 92 studies [1–92] were included in this review.

All included studies were cohort studies, whether prospective or retrospective. In all included cohorts, patients were treated with

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THA and reportedly achieved good outcomes in terms of satisfaction, range of motion, restoration of limb length, and function. Debate regarding the extent of acute lengthening that is safe to undertake in patients who have dysplasia undergoing THA continues because of the established and well-recognized risk of neurological complications, specifically sciatic nerve palsy. Based on conventional teaching, acute lengthening of the limb > 4 cm and the resulting tension on the sciatic nerve puts the extremity at an unacceptable risk of neurological complications [49]. This accepted limit to acute lengthening means that some patients who have unilateral dysplasia and a short limb (> 4 cm) cannot completely restore their full length, and instead have a residual limb-length discrepancy. The belief in the stated limit leads many surgeons to resort to performing a femoral shortening osteotomy if lengthening is likely to be > 4 cm.

Our review of the contemporary literature did not reveal a specific limit to lengthening during arthroplasty for this condition. In fact, there are reports in the literature suggesting that the limit for acute lengthening should be determined using femoral length as a reference [44]. In a study by Kabata et al., the risk for neurological complications appeared to increase when lengthening exceeded 8.7% of the femoral length [44]. There were two comparative studies by Fujishiro et al. that highlighted the influence of factors other than lengthening, such as hip flexion contracture, regarding neurological complications in patients undergoing THA [9,60]. Another study proposed 50 mm as a limit for acute lengthening [92]. Lengthening up to 51 mm was seen in some of the 58 studies that used femoral shortening osteotomy. There were 13 studies included in cohorts of patients who had Crowe IV dysplasia when femoral osteotomy was not performed during THA. The mean limb lengthening in these patients ranged from 21 to 48 mm. In nine studies, patients were subjected to staged procedures whereby lengthening occurred during a preliminary procedure. If neurological complications did not occur, definitive THA was performed during a second surgery. These studies reported a mean lengthening ranging from 36 to 100 mm, with the first-stage operations involving a variety of procedures. The initial lengthening might be achieved with a distraction nail, ilio-femoral fixator, or even initial hip periarticular extensive soft-tissue releases and traction.

Some techniques, distinct from femoral osteotomy and staged procedures, have been described with the aim of achieving reduction of the femoral head into the true acetabulum with minimal complications. Yan et al. described maintaining the hip and knee in a flexed position following surgery and then allowing for gradual knee extension until the patient notes the onset of numbness. They achieved an average lengthening of 40 mm (range, 29 to 62) using this technique [12]. Shemesh et al. reported using an intraoperative nerve stimulator to assess neurological insults during THA procedures [81]. They stated that intraoperative nerve monitoring mitigated the risk of nerve palsy and reduced the need for femoral shortening osteotomies. These findings were corroborated by Kong et al. in their comparative retrospective cohort, demonstrating a lower incidence of nerve palsy when intraoperative nerve monitoring was used during complex THA [73].

In conclusion, there is only limited and conflicting evidence about the potential limit of acute lengthening in patients undergoing THA, after which the risk for neurological complications increases. In the absence of any definitive limit, surgeons may decide to lengthen the extremity more than 4 cm to achieve equal limb length and avoid leaving these young patients who have a possibly major residual limb-length discrepancy. With careful intraoperative monitoring and maintaining the knee in a flexed position intraoperatively and postoperatively, restoration of length may be considered in selected cases.

Availability of Data and Material (Data Transparency)

All data and material are available when required.

Code Availability (Software Application or Custom Code)

All software application and custom codes are available when needed.

Consent for Publication

Consent for publication was obtained.

CRediT authorship contribution statement

Ibrahim El-Ganzoury: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation. **Mohammad T. Ghazavi:** Writing – review & editing, Writing – original draft. **Vahit Emre Özden:** Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization. **Jesus Moreta:** Writing – review & editing, Methodology. **Oussama Chaar:** Writing – review & editing. **Vorawit Atipiboosin:** Writing – review & editing. **Ömer F. Bilgen:** Writing – review & editing. **Daisuke Inoue:** Writing – review & editing. **Peilai Liu:** Writing – review & editing. **Yanguo Qin:** Writing – review & editing. **Ahmed S. Younis:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization.

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