OPEN

PRS GLOBAL OPEN

CASE REPORT
Reconstructive

Excessive Aesthetic Lower Limb Elongation Management

Aleksander S. Barinov, MD, PhD*
Aleksander A. Vorobyev, MD, PhD*
Viktor V. Shtatov, MD, PhD*
Ekaterina A. Barinova, MD, PhD*
Vladimir N. Nikolenko, MD, PhD‡
Alexey N. Barinov, MD§
Mikhail Y. Sinelnikov, MD||

Summary: With the evolution of surgical techniques and increased availability of cosmetic orthopedic surgery, new complications manifest. Uncontrolled lower limb elongation without limitations can be achieved by disinformation and undergoing surgery in different countries. Patients receive excessive surgical intervention due to misinforming surgeons and clinics of their previous medical history. We present a previously undocumented case of excessive lower limb elongation in an adult male patient and a treatment method for this novel pathology. Lack of personal constraint and severe aesthetic discomfort led the patient to undergo 3 elongation procedures in 3 clinics in different countries. Correction of excessive elongation is a delicate procedure, which must account for previous medical history, the patient's psychological status, and strict adherence to anatomical standards. In this case, we managed to correct the complications from hyper-elongation by restoring the normal anatomical proportions of the lower limbs. The patient consented to publication of these findings and has undergone psychiatric evaluation in a specialized clinic after corrective surgery. It is important to properly educate patients of surgical risks and to evaluate all aspects of patient psychosomatic well-being before surgical intervention. Advances in aesthetic medicine underline the development of new iatrogenic pathologies. Excessive lower limb elongation can lead to significant musculoskeletal deformation, requiring precise surgical correction with account to normal anatomical proportions. *(Plast Reconstr Surg Glob Open 2020;8:e2793; doi: 10.1097/GOX.0000000000002793; Published online 24 April 2020.)*

Surgical lower limb shortening and elongation are well-known procedures in the management of leg length discrepancy and related pathology.[1,2] Lower limb lengthening has also been applied for correction of short stature, a cosmetic procedure involving extraneous surgical intervention, and associated with lengthy rehabilitation and certain risks.[3,4] Modern advances in cosmetic elongation have provided higher safety and better overall outcome due to modification of existing techniques and special attention to patient rehabilitation.[5–7] Although existing leg lengthening procedures are accompanied by a lower complication rate and high patient satisfaction, patient dissatisfaction is not uncommon due to the psychological aspects of height management.[8,9] Here, we present a previously unreported case of surgical treatment of excessive cosmetic lower limb elongation.

CASE REPORT

A 31-year-old man with no previous medical history underwent 3 cosmetic leg elongation procedures in 3 different clinics from 2008 to 2018 [**see figure, Supplemental Digital Content 1,** which displays patient length: (A) before surgery; (B) after primary elongation; (C) after 3 elongation procedures; and (D) after corrective lower limb shortening, **http://links.lww.com/PRSGO/B367**].

Before the first elongation surgery, the patient was 178-cm tall and displayed dissatisfaction with his height. The patient came to Volgograd State University Medical Centre with the required paperwork from a certified

*From the *Volgograd State Medical University, Russian Federation, Volgograd, Russia; †Moscow State University, Russian Federation, Moscow, Russia; ‡Department of Normal Anatomy, Sechenov University and Department of Anatomy, Moscow State University, Moscow, Russia; § Department of Neurology and Neuropathology, Sechenov University, Russian Federation, Moscow, Russia; and ||Institute for Regenerative Medicine, Sechenov University, Russian Federation, Moscow, Russia.*

Received for publication January 7, 2020; accepted February 28, 2020.

DOI: 10.1097/GOX.0000000000002793

Disclosure: *The authors have no financial interest to declare in relation to the content of this article.*

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

psychologist and underwent his primary cosmetic lengthening by elongation of lower limb segments with preservation of normal anthropometric proportions. According to existing clinical recommendations on lower limb elongation,[10] the maximum allowed elongation was 5.29 cm. The patient underwent bilateral tibial and fibular elongation with traction and external fixation by Ilizarov apparatus (Russian Federation) for 112 days. As a result, the lower limbs were elongated by 5 cm, with no axial deformation, no movement limitations, and no other complications.

Several years later, the patient was refused secondary elongation at the same clinic due to negative prognosis. Despite this, the patient sought treatment elsewhere. In 2012, the patient underwent secondary elongation by method of external fixation and traction at an undisclosed clinic in China. This procedure yielded a 5-cm elongation of both femoral bones. Three years later, in 2015, the patient underwent a third elongation procedure in Germany, which provided another 5-cm increase in patient height, by method of tibial elongation with external fixation. His height after all 3 elongation procedures was 192 cm (+15 cm). After the third elongation and removal of external fixation elements, the patient developed a knee flexion contracture and an equinus deformity of the feet (**see figure, Supplemental Digital Content 2,** which displays an x-ray series of corrective shortening of right and left tibiae, **http://links.lww.com/PRSGO/B368**).

Conservative treatment was attempted without effect.

Anthropometric evaluation showed that his lower limb length was 20.7 cm greater than normal for his new height and 36.8 cm greater than normal for his initial height. Femoral length was 9.7 cm greater, and crus was 11 cm greater than the associated median. Significant segmental disproportion of the lower limbs was noted. The patient experienced difficulty walking and standing up from a sitting position without aid. Unsuccessful rehabilitation attempts and deterioration prompted the patient to seek surgical correction at our clinic at Volgograd State University Medical Centre.

Corrective surgery was required to restore normal anthropometric proportions, correct acquired complications, and management of pain. Upon evaluation at our clinic, the left lower limb was 1.5 cm shorter than the right (Table 1). Surgical shortening of the lower limbs was recommended. Due to the presence of overextended tissues, scar tissue formation, elongated vasculature, and increased soft-tissue tension, a multi-stage correction was necessary to limit tissue damage and thrombosis risks, as well as facilitate proper tissue adaptation. A bilateral 10-cm long Z-osteotomy of tibial diaphyses in the middle third was performed with removal of proximal and distal components by 5 cm. Intraoperatively, a 1 cm overlap of bone fragments was achieved. Consequent shortening via traction was performed gradually in the postoperative period after stabilization and physical rehabilitation procedures. The rate of shortening was 2 mm per day for 20 days. As a result, the crus was shortened by 5 cm, restoring acceptable proportions of the lower limbs. Ilizarov apparatus also allowed for correction of existing valgus deformity. Overall rehabilitation after corrective surgery was 11 months; complete functional rehabilitation was achieved.

DISCUSSION

Highly intelligent patient capabilities often lead to misinformation of medical personnel and uncontrolled surgical treatment. Cases such as ours have not been described in literature, but it is highly likely that such patients are not rare, but are undocumented due to treatment in different clinics, even countries. Lower limb elongation remains a unique and generally safe method of cosmetic correction of short stature.[11] Despite this, patient selection should include psychiatric evaluation and perioperative education on risks associated with excess lengthening.

In the rare circumstance of shortening procedures after hyper-elongation of lower limbs, tissue tension and vasculature restructurization should be noted. To limit the risks associated with immediate tension release, corrective shortening should be performed gradually, with constant monitoring of soft tissues, joint movements, pain levels, and sensory- and perfusion-related anomalies. In the presented clinical case, a reduction speed of 2 mm a day for 20 days allowed for correction of complications and positive outcome.

Uncontrolled elongation leads to changes in weight distribution, which undermines the efficacy of this

Table 1. Anthropomorphic Data

	Before Elongation, 2008		After 3 Elongation Procedures, 2017		After Corrective Shortening, 2018	
Height (cm), standing	178		192		187	
Height (cm), sitting	93		93		93	
	Right	**Left**	**Right**	**Left**	**Right**	**Left**
Lower extremity length (cm) (from superior–anterior from the anteroposterior spine of the pelvis to the edge of the inner ankle)	99	99	112.5	111	107.5	107
Thigh length (cm) (from the top edge of the greater trochanter to the fissure of the knee joint)	52	52	56	54	56	54
Crus length (cm) (from the knee joint to the edge of the inner ankle)	41	41	51	51	46	46
Crus circumference (cm) (middle segment)	39	38	44,5	45	43	43,5
Thigh circumference (cm) (middle segment)	55	54	58	53	58	54
Arm length (cm)	82	81	—	—	—	—

procedure. To limit the rate of this pathology, it is important to account for maximum acceptable elongation and not exceed this limit. This constant is derived from preoperative anthropometric assessment and should be clearly stated to the patient.

This case report highlights the importance of proper patient education and psychiatric evaluation and the risks associated with uncontrolled cosmetic altering of anatomical proportions, which can lead to significant deterioration of life quality. We offer our primary experience in correction of excessive elongation. To achieve best aesthetic elongation results, it is important to maintain proper anthropomorphic proportions. We believe that lower limb lengthening should not exceed one SD from median lower limb length for the patient's height. It is important to develop a standardized approach to management of patients undergoing aesthetic elongation procedures to account for possible lack of patient compliance with clinical recommendations which can lead to uncontrolled surgical intervention.

Mikhail Y. Sinelnikov, MD
Institute for Regenerative Medicine
Sechenov University
Russian Federation
Udaltzova Ulitza, 4, 370
Moscow 119415, Russia
E-mail: mikhail.y.sinelnikov@gmail.com

REFERENCES

1. Gurney B. Leg length discrepancy. *Gait Posture*. 2002;15:195–206.
2. McCarthy JJ, MacEwen GD. Management of leg length inequality. *J South Orthop Assoc*. 2001;10:73–85; discussion 85.
3. Gubin AV, Borzunov DY, Malkova TA. Ilizarov method for bone lengthening and defect management: review of contemporary literature. *Bull NYU Hosp Jt Dis*. 2016;74:145.
4. Guerreschi F, Tsibidakis H. Cosmetic lengthening: what are the limits? *J Child Orthop*. 2016;10:597–604.
5. Elbatrawy Y, Ragab IM. Safe cosmetic leg lengthening for short stature: long-term outcomes. *Orthopedics*. 2015;38:e552–e560.
6. Park KB, Kwak YH, Lee JW, et al. Functional recovery of daily living and sports activities after cosmetic bilateral tibia lengthening. *Int Orthop*. 2019;43:2017–2023.
7. Hamdy RC, Bernstein M, Fragomen AT, et al. What's new in limb lengthening and deformity correction. *J Bone Joint Surg Am*. 2016;98:1408–1415.
8. Novikov KI, Subramanyam KN, Muradisinov SO, et al. Cosmetic lower limb lengthening by Ilizarov apparatus: what are the risks? *Clin Orthop Relat Res*. 2014;472:3549–3556.
9. Kranzler JH, Rosenbloom AL, Proctor B, et al. Is short stature a handicap? A comparison of the psychosocial functioning of referred and nonreferred children with normal short stature and children with normal stature. *J Pediatr*. 2000;136:96–102.
10. Egorov MF, Barinov AS, Vorobyev AA, et al. *Orthopaedic Cosmetology: New Technologies in Elongation Procedures*. Volgograd, Russia: "PRINT"; 2004. (In Russ.)
11. Dinah AF. Predicting duration of Ilizarov frame treatment for tibial lengthening. *Bone*. 2004;34:845–848.