Eur Spine J (1999) 8 : 329–331

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Halo femoral traction and sliding rods in the treatment of a neurologically compromised congenital scoliosis: technique

Received: 6 January 1999
Accepted: 12 April 1999

Study conducted at the Shriners Hospital for Children and the Montreal Children's Hospital, McGill University, Montreal, Quebec, Canada. No support from any source was received for this study.

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Abstract In severe congenital scoliosis, traction (whether with a halo or instrumental) is known to expose patients to neurologic complications. However, patients with restrictive lung disease may benefit from halo traction during the course of the surgical treatment. The goal of treatment of such deformities is, therefore, twofold: improvement of the respiratory function and avoidance of any neurologic complications. We report our technique to treat a 17-year-old girl with a multi-operated congenital scoliosis of 145° and cor pulmonale. Pre-operative halo gravity traction improved her vital capacity from 560 cc to 700 cc, but led to mild neurologic symptoms (clonus in the legs). To avoid further neurologic compromise, her first surgery consisted of posterior osteotomies and the implantation of two sliding rods connected to loose dominoes without any attempt at correction. Correction was then achieved over a 3-week period with a halofemoral traction. This allowed the two rods to slide while the neurologic status of the patient was monitored. Her definitive surgery consisted of locking the dominoes and the application of a contralateral rod. Satisfactory outcome was achieved for both correction of the deformity (without neurologic sequels) and improvement of her pulmonary function (1200 cc at 2 years). This technique using sliding rods in combination with halofemoral traction can be useful in high-risk, very severe congenital scoliosis.

Key words Congenital scoliosis · Cor pulmonale · Halofemoral traction · Sliding rods

Introduction

Halotraction has been used prior to reconstructive surgery in the treatment of severe scoliosis [1] and in cases of cor pulmonale [5]. Earlier treatment of severe curves and the advent of modern instrumentation has made its use rare. Sliding rods (or growing rods) [2, 4, 6] have been used in the treatment of scoliosis in young children in order to allow longitudinal growth of the spine. This requires dominoes that cross-link the two rods together and sequential lengthening, usually every 6–9 months. Their use has never been reported in conjunction with halofemoral traction to monitor a neurologically compromised patient with severe spinal deformity. We report on a technical note where both halofemoral traction and a non-locked sliding rods system can be used.

Case report

A 17-year-old girl was admitted to our institution for shortness of breath after walking a few steps, and cyanosis at rest. Her oxygen saturation was 80% at rest, and dropped to 50% at night during episodes of sleep apnea. Her pulmonary function tests (PFT) showed severe restrictive pattern [FVC (forced vital capacity) = 560 cc (16%), FEV_1 (Forced respiratory volume in one second)/FVC: 81%]. Clinical examination (Fig. 1) showed a severe pelvic obliquity with apparent leg length discrepancy and a severe spine deformity measuring 145° by the Cobb method (Fig. 2). In the past, she had undergone multiple spinal procedures for her congenital scoliosis, including closure of a thoracic meningocele, a T7


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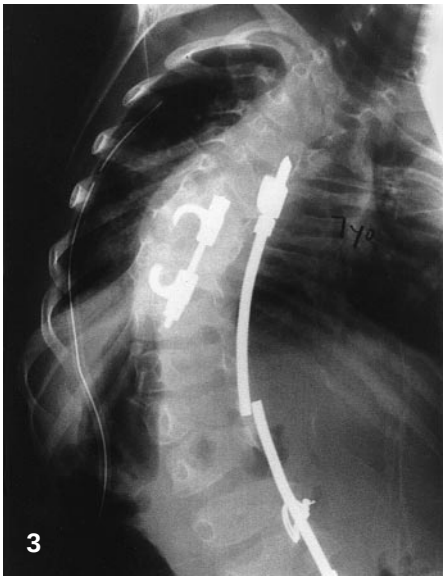
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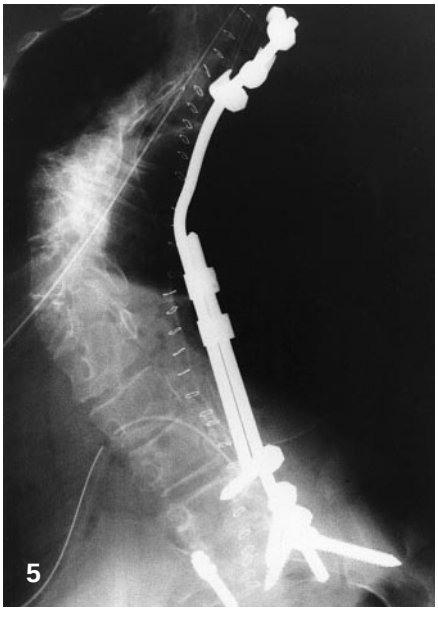
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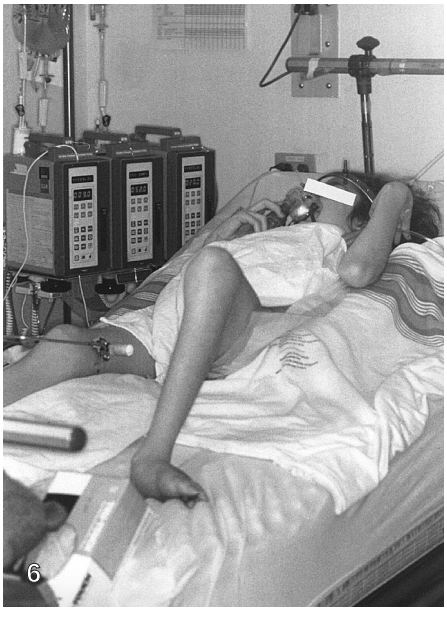
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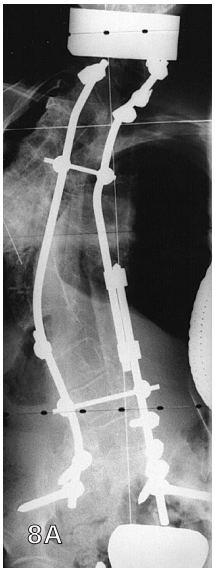
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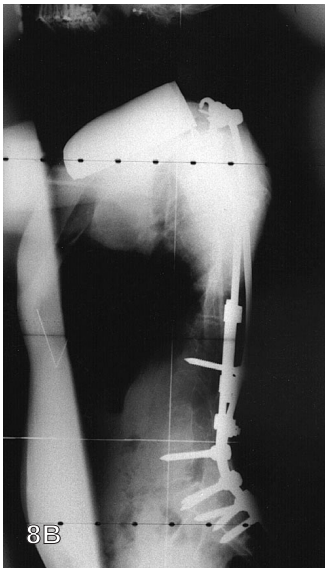
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◀ **Fig. 1** This 17-year-old girl presented with shortness of breath and pelvic obliquity

Fig. 2 The curve measures 145° and is extremely rigid

Fig. 3 By age 7 the patient had already undergone closure of a thoracic meningocele, a T9 hemiresection at 3 years of age, an anterior spine fusion T5-T11, and a subcutaneous posterior Harrington distraction rod, now broken. A new instrumentation with fusion down to L5 was then done at age 8, which was removed 2 years later. No further surgical treatment was done until she presented at 17 years of age

Fig. 4 Preoperative halo-gravity traction maintained for a period of 8 weeks

Fig. 5 Posterior approach, posterior osteotomies, and costectomies at the apex on the concave side allow the positioning of two sliding rods linked by two dominoes, which are not tightened

Fig. 6 Postoperative halofemoral traction on the "short" right leg

Fig. 7 After 3 weeks one can observe the lengthening of the sliding rods, by the increasing distance between the dominoes

Fig. 8 Left convex instrumentation with compression of the bottom curve and minimal distraction of the two sliding rods. Two tibial struts (autograft) from the right and left tibiae are inserted into the concavity

Fig. 9 Final result at 2 years

hemivertebra resection, and multiple rods procedures (Fig. 3). To prepare her for surgery, treatment was started with halogravity traction progressively brought to 35 lbs (15.88 kg) (Fig. 4), chest physiotherapy and BIPAP (bilevel positive airway pressure). After 2 months the curve had been reduced from 145° to 104°. The PFT showed a mild improvement, with an FVC of 700 cc. However, her neurologic function showed brisk reflexes in the right lower extremity and mildly decreased strength and partial sensory loss on the dorsum of the foot. The somatosensory evoked potentials (SSEP) had disappeared (SSEP with normal waves were documented before halo traction). It was therefore decided to perform a posterior release with posterior osteotomies without correction through a posterior approach and, if possible, through an anterior thoracotomy. During surgery, the patient desaturated on several occasions, precluding any anterior approach. Several costectomies on the concave side had to be done to place the rods. Only the concave instrumentation was inserted, with two sliding rods through two dominoes (Fig. 5). The dominoes were not tightened, so the correction could be initiated post-operatively only. The sliding portions of the rods were purposely not contoured, but were left straight to permit subsequent lengthening. This was done with halofemoral traction on the "short" right leg (Fig. 6), pursued over a 3-week period, with steeply progressive weight increments [up to 35 lbs (15.88 kg) on the head and 15 lbs (6.8 kg) on the leg] and careful neurologic monitoring. Repeated spine radiographs documented the lengthening of the rods (Fig. 7). After 3 weeks, once the correction was judged to have been maximized, she was reoperated (Fig. 8). Two tibial strut grafts were harvested first, from the right and left tibiae. Instrumentation of the convex side was finished with a lumbar pedicle screw in L1 and a top pedicle hook at T2. Compression was achieved on the left in the lumbar spine. The concave side was then minimally distracted by means of the two dominoes and the "sliding rods". A wake-up test was immediately carried out and found to be normal, the two tibial struts were inserted along the gravity line. At 24-months follow-up, the correction was very satisfactory (Figs. 8, 9) and the pelvic obliquity was completely corrected. The PFT shows excellent improvement: FVC = 1200 cc (30%), FEV_1/FVC = 92%).

Discussion

Classically, halofemoral traction is not indicated in rigid congenital scoliosis, and may risk neurologic complications [3]. However, in the case of severe respiratory compromise, it can allow the spine to elongate and improve respiratory function [5]. Its use must, therefore, be carried out with extreme caution and monitored neurologically very thoroughly. The time necessary to achieve the desired result may be several weeks (8 weeks in our case). In our patient it did allow the pelvis to be disincarcerated from the concave chest and lengthening of the abdomen. The diaphragmatic billows were therefore improved. Before the first operation (release, osteotomies and costectomies) we were faced with a subtle neurologic impairment; therefore, any kind of surgical distraction was contraindicated. We chose the sliding rods in order to stabilize the spine (at least in translation), and to monitor the neurologic function of the lower extremities, leaving halofemoral traction to achieve the final correction. During final surgery minimal distraction was done. This method of correction relies on similar principles as the intermittent distraction rod for correction of high-neurologic-risk congenital scoliosis, done by Grass et al. [2]. In our method, distraction is, however, constant and may therefore take better advantage of the viscoelasticity of the spine.

Acknowledgement We acknowledge the assistance of Mark Lepik from the Shriners Hospital for the illustrations.

References

1. Cummine JL, Lonstein JE, Moe JH, Winter RB, Bradford DS (1979) Reconstructive surgery in the adult for failed scoliosis fusion. J Bone Joint Surg [Am] 61:1151–1161
2. Grass PJ, Soto AV, Araya HP (1997) Intermittent distracting rod for correction of high neurologic risk congenital scoliosis. Spine 22:1922–1927
3. MacEwen GD, Bunnel WP, Sriram K (1975) Acute neurological complication in the treatment of scoliosis. A report of the Scoliosis Research Society. J Bone Joint Surg [Am] 57:404–408
4. Puno R, Perra J, Glassmann SD, Dimar JR (1997) Instrumentation without fusion for juvenile idiopathic scoliosis using a new growth rod. Presented at the 32nd Annual Meeting of the Scoliosis Research Society, Saint Louis, Sept 24–27
5. Swank SM, Winter RB, Moe JH (1982) Scoliosis and cor pulmonale. Spine 7:343–354
6. Wilke HJ, Kluger P, Naumann T, Kron T, Claes LE, Puhl W (1996) In situ rigidity of a new sliding rod for management of the growing spine in Duchenne muscular dystrophy. Spine 21:1957–1961