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Clinical Use of the Halo

Case Reports Using Skeletal Traction Apparatus

Louis Z. Shifrin, M.D.*

Successful experience with the halo, a circular frame originally designed for fixation of facial fractures, has encouraged continued and broadened use. All physicians should be aware of this technique so that it can be considered for application when appropriate.

Skeletal traction is a well-established method of management in the practice of orthopedic, neuro and plastic surgery. Innovations such as the halo apparatus offer improved efficiency and wider applications of skeletal traction. Originally designed to assist in the fixation of facial fractures, the halo has been modified to perform many other functions. The halo is a circular frame that has apertures through which four pins are threaded into the outer cortex of the skull. The tips of the pins are so designed that deeper penetration is unlikely. No incisions in the scalp are necessary. Except in young children, the procedure can be done under local anesthesia. When these pins are placed symmetrically in the skull anteriorly and posteriorly, rigid fixation is obtained. The following five case reports demonstrate some of the indications and the techniques of application of the halo apparatus.

Case Reports

Case 1: A three-year-old boy was transferred to Henry Ford Hospital on July 22, 1971, one week after having been struck by an automobile. He had been treated for a brain concussion and then referred to our hospital for treatment of a fracture dislocation of C-1, C-2. At the time of the admitting examination, the boy was comfortable in a soft collar and, surprisingly, had no neurologic deficit. Radiographs revealed a fracture and complete forward displacement of the odontoid process along with the first cervical vertebra. Crutchfield skull tongs were inserted but, despite increasing weight and adjustment of position, a satisfactory reduction was not possible. (Figure 1) Because the patient's hyperactivity in bed might loosen the tongs in a short time, a halo was applied on August 6, under Ketamine Hydrochloride anesthesia. The halo apparatus was incorporated into a body cast. During subsequent days, the halo was adjusted in position to obtain maximum reduction. Six days later, the cast was bivalved, removed and a posterior fusion was performed from C-1 to C-2 using a tibial bone graft. This was done under general anesthesia by Robert S. Knighton, M.D., Department of Neurosurgery. During the procedure, traction was

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Three-year-old male with dislocation of first cervical vertebra unreduced by traditional skull traction methods.

Reduction and immobilization obtained with halo-cast. Immediately after surgery the cast was reapplied with halo attached. There were no postoperative complications. Because of the unreliable behavior of a patient so young, the boy was kept in bed to protect the weakened tibia. Minor reactions at the pin sites were easily managed by cleansing and occasional tightening of the pins. On October 19 the halo-cast was removed and the boy wore a soft collar until he was discharged on November 7. Recent examination showed a normal neurologic status. Radiographs reveal a solid fusion. The fracture at the base of the odontoid has also healed.

Comment: The halo-cast allowed a rigid fixation and satisfactory reduction, to be maintained long enough to insure successful fusion. Neurologic complications were avoided.
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1c Patient in halo-cast. Close-up photograph demonstrates placement of pins.
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Figure 2 (Case 2)

2a Eleven-year-old female developed severe lumbar lordosis and scoliosis after complication of lumbar peritoneal shunt requiring extensive laminectomies at age 5.

2b Stability of curve obtained preoperatively with halo-femoral traction and still maintained 3 months postfusion by cast.

Case 2: An eleven-year-old girl was admitted to Henry Ford Hospital on November 7, 1971 for correction of a spine deformity. As an infant, she had hydrocephalus, which was treated by a lumbar subarachnoid shunt. (See report by Kushner, et al1) When she was age 5, an extensive, complete lumbar laminectomy was necessary because of arachnoiditis. Over the following years, she developed a progressive lumbar lordosis and scoliosis. Admission examination showed that the child was of normal or above average intelligence. Neurologic examination was unremarkable. A rigid hyperlordosis and right lumbar scoliosis was present, with an associated pelvic tilt. Radiographs, taken with the patient recumbent and bending, demonstrated the rigidity of the deformity and confirming the impression that correction could not be obtained satisfactorily by cast or Harrington instrumentation alone. With the hope of allowing greater flexibility of the spine, an operation was done on November 11 under general anesthesia and through a posterior incision. The contracted dorsal-lumbar fascia was excised and the erector spinae were released from the posterior iliac crests. The patient was then turned supine and the halo was applied. Skull radiographs revealed craniotomy defects that made proper placement of the pins more critical than usual. Steinman pins were placed in each distal femur (halo-femoral traction). Applied weight was increased gradually up to 30 pounds. After radiographs showed satisfactory mobilization of the curve, a posterior-lateral fusion was done November 23 with the patient in a prone position. Harrington instrumentation could not be used because of extreme lor-
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dosis. Halo-femoral traction was discontinued post-operatively. On December 6, a corrective scoliosis cast was applied, incorporating one thigh. Followup examination after three months shows that the correction is well maintained and the fusion is progressing satisfactorily. The patient continues to be immobilized in a cast.

Comment: Halo-femoral traction provided mobilization of a rigid curve. Good postoperative correction with the cast was attributable to the halo-femoral technique.

Case 3: This patient was admitted to the hospital on October 31, 1971. He was 49 years old and known to have an occipital atlanto-axial anomaly that had required two previous decompressive procedures, both anteriorly and posteriorly. He was admitted because of an atonic bladder and other symptoms of high cervical and bulbar compression. The patient demonstrated decreased sensation in the left side of the body, decreased vibration perception bilaterally in the lower extremities, moderate weakness in the upper and lower extremities and hyperactivity of deep tendon reflexes. The right Babinski's reflex was positive and he had bilateral positive Hoffman's reflexes. On November 3, Vinke tongs were applied. Symptoms and findings improved while the patient was in traction. Five days later, a posterior fusion was performed from the occiput to C-3 by J. Speed Rogers, M.D., Department of Neurosurgery, and Charles C. Schock, M.D., Department of Orthopedic Surgery. On November 23, a halo cast was applied under local anesthesia. This allowed the patient to be safely ambulatory the following day. Slight drainage from one of the anterior pin sites subsided with tightening of the pin. The patient wore a halo-cast until the following February 3, 1972, when he was placed in a neck brace. Radiographs have revealed a successful fusion and the patient has shown no neurological progression.

Comment: Rigid fixation allowed ambulation without worsening the patient's neurologic state and permitted successful fusion. Avoiding confinement to bed of a patient of this age, and with a neurogenic bladder, is highly desirable.

Figure 3 (Case 3)

3a, left, 49-year-old male with congenital occipital atlanto-axial anomalies causing cord impingement. Decompression procedures were unsuccessful.

3b Satisfactory fixation of spine was obtained while the patient was ambulatory in halo-cast until fusion was obtained.
Case 4: Scoliosis and mild pectus excavatum was known in this 21-year-old male since age 14 but he had received no treatment. Our orthopedic clinic first saw him on August 9, 1971, when he complained of progressive deformity, increasing shortness of breath and pain in the upper back. Examination revealed a right thoracic curvature and a left cervical thoracic curve. Films of bending action showed very little flexibility. The thoracic curve measured 84° and the cervical thoracic curve measured 45°. Pulmonary function tests revealed normal blood gases but a restrictive impairment of pulmonary function with some element of bronchospasm. On November 9, a halo was applied under local anesthesia. Pins were placed through each distal femur. Skeletal traction was started the next day, increasing at 3-pound intervals until a total of 42 pounds' traction was applied. X-rays showed gradual improvement of the deformity. A spine fusion was performed November 17, from T-3 to L-1 using Harrington instrumentation. For this, the patient was anesthetized and put in a prone position, with the traction still being applied. Postoperatively, the patient had some numbness in

Figure 4 (Case 4)

4a A 21-year-old male had severe scoliosis with associated symptoms of dyspnea and pain.
4b Pre-operation mobilization was obtained with halo-femoral traction.
4c Final correction is quite satisfactory.
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4d Patient in bed with halo-femoral traction.

his left thumb but this subsided spontaneously. On November 29, an ambulatory Risser cast was applied and halo-femoral traction removed. The thoracic curve measured 47°; the cervical thoracic curve measured 37°. On December 7, though ambulatory, the patient was unable to flex his knees beyond 20° because of discomfort. He was placed under light general anesthesia and the knees were very easily manipulated to full flexion. He subsequently regained full motion and use of the lower extremities. He was discharged on December 11 wearing an ambulatory cast, which was removed after six months.

Comment: Gradual straightening of a rigid curve minimizes risk of neurologic complications and improves final correction.

Case 5: This 31-year-old woman was admitted to the hospital on November 28, 1971. She supposedly had had meningitis at age 10 and, at age 13, a back deformity was noted. She was treated with a brace for several years without improvement. Over the following years she noticed progressive deformity, had episodes of paresthesias in both hands, shortness of breath and easy fatigability. She has three children, ages 5, 7 and 9. The patient said that she was also having marital difficulties and receiving psychiatric treatment. Her psychiatrist felt that her severe deformity was contributing to her emotional problems. On examination she appeared to be in some respiratory distress. She stood 4'3"; her predicted height (based on her arm span) was about 4'10". She had a decompensated deformity of the chest, with the rib cage resting on the iliac crest. Radiographs revealed a 140° right thoracic curve which showed no appreciable straightening when bending. Pulmonary function tests revealed normal blood gases. Electrocardiogram was normal, but pulmonary function was severely restricted to about 35% of normal. The halo and a pelvic hoop were applied December 7, under general anesthesia. The hoop was attached by placing threaded pins through each ilium and connecting them with an outside metal hoop similar to the halo apparatus. Two days later, with the patient in standing position, turnbuckles were applied to the halo and
pelvic hoop. Over the next two months, gradual distraction was obtained by daily turning of the turnbuckles. Persistent paresthesia in the hands prevented further distraction after about 8.5 cm. The paresthesia has subsequently disappeared. When pulmonary function tests and blood gases showed no improvement or deterioration, an elective tracheostomy was performed on February 4 by Romauld T. Szymkowski, M.D., Department of Otolaryngology. Intubation was begun on February 10. The patient was placed prone and posterior turnbuckle removed, but the remainder of the halo-pelvic distraction was continued. Posterior fusion was done from T-1 to mid-lumbar spine using allograft bone. The wound healed per primum and the patient was ambulatory within a week, at which time the tracheostomy tube was removed. Radiographs show correction to about 100° in the thoracic spine. The patient is now being treated in the halo-pelvic apparatus as an outpatient, commuting from a nearby city at two-week intervals for examination.

Figure 5 (Case 5)

5a this 31-year-old female had progressive deformity causing not only dyspnea, pain, fatigue, but also increasing emotional disturbances.

5b Correction and fixation by halo-pelvic traction and maintained after fusion.
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Discussion

This series of case reports is not meant to be an exhaustive discussion of the use of the halo. Interested readers may consult recent articles by Perry, Pieron and O'Brian containing up-to-date descriptions on the use of the halo apparatus. Our experience shows that the halo is easy to apply, (easier, I believe, than the other skull traction apparatus that we commonly use). It is more versatile when used with other techniques such as the halo-cast, halo-pelvic, halo-femoral and halo-Milwaukee brace. There is broadening application of the halo, so that it is becoming important not only to physicians at large institutions, but also in private practice. Examples of orthopedic and neurosurgical problems treated with the halo have been presented. Plastic surgeons may find use for the halo in the management of burns about the head and neck, as well as for facial fractures. We have been blessed with no significant complications in our cases. In my discussions with others, I find that their experience is also generally favorable.

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