HALO TRACTION*

A. P. PIERON and W. R. WELPLY, WINNIPEG, MANITOBA, CANADA

From the Department of Orthopaedic Surgery, the Children's Hospital, University of Manitoba

The aim of this paper is to present the various uses of halo traction in children and adults rather than to give a statistical survey of the cases in which this method has been used.

This instrument was devised and developed by Nickel, Perry, Garrett and Snelson (1960) from Bloom's apparatus for stabilisation of facial fractures. It was introduced in particular to stabilise the collapsing spines of patients paralysed by poliomyelitis (Perry and Nickel 1959; Garrett, Perry and Nickel 1961). Plaster splints had been used for these patients but difficulties

FIG. 1

FIG. 2

FIGS. 1 AND 2

Figure 1—The components of the halo apparatus. Figure 2—The second ring mounted on the halo with a clamp (*top centre*) prevents the ends of the pins from catching in the bed-clothes. The ropes are attached through the loops. There are four loops—at 1, 5, 7 and 11 o'clock, so that the direction of pull can be varied.

and complications were often encountered, including prognathism, displacement of teeth, impaired chewing, inadequate immobilisation (especially in patients undergoing operation to stabilise the neck or spine), embarrassment of respiratory function, skin irritation and pressure sores.

The halo apparatus consists of a head ring, mounting brackets, overhead support, suspension assembly, and skull pins with a lock nut and Allan grub screw to prevent inadvertent penetration of the skull by the pins (Fig. 1).

We have added a second ring to prevent the pins from catching in the bed-clothes (Fig. 2), special loops for weight traction to control the position of the head, and nylon pin inserters

* A version of this paper was presented at the Canadian Orthopaedic Association meeting on June 3, 1968.

(Fig. 3), to make the application of the halo much simpler. We have also slotted the grub screws so that they may be tightened with a screwdriver instead of an Allan wrench. The skull pin has a round hollow-ground point which prevents excessive penetration and engages in the outer table only (Fig. 4). The skin is sealed by the shape of the pins. The pins are easy to apply under either local or general anaesthesia.

TECHNIQUE OF APPLICATION

The hair is shaved circumferentially in a zone two or three centimetres wide just above the ears and eyebrows. When possible a hexochlorophene shampoo is used on the hair on the preceding evening. Only the pins need to be sterilised but we prefer to sterilise the halo ring, the pins and the locking devices.

The halo ring is applied to the head and the sites for the pins are marked, the ring is removed and the four sites are infiltrated with local anaesthetic. Four pins are inserted through the appropriate holes in the ring. The nylon turning knobs are screwed on to each pin and the pins are then screwed onward until their tips are just visible within the ring. The halo is reapplied to the head and maintained in position by an assistant while the surgeon tightens two of the pins that lie diametrically opposite each other until the points of the skull pins penetrate the skin and cortex. This only requires finger-tip force on the turning devices. The remaining two pins are tightened similarly, and after a check to see that the halo is firmly attached to the skull, the grub screws are tightened with a screwdriver and the nylon turning knobs are removed. We have recently replaced the Allan grub screws by brass lock screws with a straight slot. If too much force is used in application either the slots will widen or damage to the threads of the skull pins may occur, making their subsequent application more difficult and therefore inaccurate.

FIG. 3

FIG. 4

FIGS. 3 AND 4

Figure 3—The loop, the detachable nylon turning knob and the locking screw. The head of the latter is slotted. Figure 4—The skull pin. The shape of the point is such that the skin is sealed and over-penetration is prevented.

Finally the four lock nuts are applied and tightened with a wrench. It is possible to use the large halo for children if the locking nuts are placed loosely on the pins inside the halo ring before applying the apparatus to the head and subsequently tightened outwards against the ring.

Dressings are not applied around the pins because they seem to irritate the patient, who by constantly fingering them may introduce infection. Painting the area around each pin daily with tincture of merthiolate or an iodine-containing detergent (Moe 1967) is all that is required.

If skin infection arises a new pin can be inserted through another hole and the old one removed. Infection is infrequent because of the rigid fixation. Irritation is usually negligible and the pins can be left in place for several months.

Skin irritation may be caused by faulty technique in applying the halo. If the patient's head is held by the hair the scalp will be pulled proximally. After insertion of the pins, release

FIG. 5

FIG. 6

FIGS. 5 AND 6

Figure 5—The skin is buckling on the pins because the head was held by the hair during insertion. Note that the pins have been inserted at the correct sites—just behind the temporal ridges. Figure 6—The shoulder straps are elevated on plastic foam to prevent pressure over the shoulders while the spine is being stretched.

of the hair allows the scalp to return to its natural position, and its buckling on the pin may result in local necrosis (Fig. 5). The pin must not be inserted through the belly of the temporalis muscle lest movement with chewing cause pain and possible infection.

Counter-traction is achieved by fixing the suspension assembly on to a body plaster. Adjustment of the apparatus allows the direction of traction to be controlled. The plaster must have elevated shoulder straps (Fig. 6) to allow for upward movement of the shoulders and must be well moulded above the iliac crests, from which the counter pressure is taken.

The patient may be ambulant and therefore independent. Spinal fusion can be done while the patient is in the plaster and traction is maintained, and tracheostomy may be done easily if required. Traction can be continued after operation for several months until healing is complete.

The only instruments required to apply a halo are a screwdriver and a spanner or small wrench. Skin incisions must never be made or infection will be inevitable. A drill must not be used to make holes for the pins in the outer table of the skull because it could lead to penetration of the inner table, osteomyelitis and possibly meningitis. To remove a halo, diametrically opposite pins are unscrewed.

HALO-FEMORAL AND HALO-PELVIC TRACTION

An alternative method of counter-traction is used in halo-femoral traction. Femoral pins (Fig. 7), preferably threaded, are inserted through the femur proximal to the condyles and epiphysial line. Light wooden spreaders are used so that single-point traction can be applied in the longitudinal axis of the body. The patient may be nursed on a Stryker bed or other turning frame.

This method is indicated for initial correction of a scoliosis curve, for assuring a position of balance, especially in adults, for gradual correction after osteotomy of the spine and for those who are unable to walk.

After fusion the traction is maintained or reapplied and further correction may occur because of ligament and muscle release at the time of operation. The special traction loops

are used to control the position of the head and neck: ropes are attached to the required loops and then to the spreader bar. The outer ring is applied to avoid catching the skull pins in the bed when the patient turns his head (Fig. 2).

Halo-pelvic traction may also be used when inability to appreciate pain as in the Riley-Day syndrome (dysautonomia) might lead to damage to the hips if prolonged femoral traction were used. A stainless steel wire is passed through the skin in the region of the greater trochanter, then through a drill hole in the ilium and through a stainless steel button on the inner aspect of the ilium, back through a second drill hole in the ilium and out through the skin again in the region of the same great trochanter (Fig. 8). Traction is taken from these wires to a

FIG. 7

Skeletal counter-traction is obtained through two femoral pins with stirrups.

FIG. 8

Pelvic counter-traction obtained through buttons on the inner posterior aspects of the innominate bones.

spreader bar just below the feet. Free movement of the legs is then possible but a large sterile dressing must be maintained over the site of the skin penetration by the wires. On one occasion this method was used successfully for several months.

DISCUSSION

We have used halo traction for cervical spine instability caused by muscle paralysis, bone or joint destruction and syringomyelia. We have also used it for reduction of dislocations and fractures of the cervical spine (Welply 1966), for correction of scoliosis in the cervico-thoracic region, for severe scoliosis or kyphosis difficult to treat by other methods, for severe scoliosis in which thoracoplasty with rib resection has been done, for fixed scoliosis with imbalance in adults following old spinal fusion and requiring osteotomy and gradual correction, for fixed scoliosis with imbalance in adults requiring traction and fusion to maintain a position of balance, for scoliosis in patients with insensibility to pain, and for paralytic scoliosis associated with paraplegia.

Halo traction has also been used successfully for the gradual correction of a fused and flexed cervical spine in ankylosing spondylitis under direct vision; osteotomy has been done under local anaesthesia with the patient in a sitting position (Freeman 1961, Simmons 1968). It has been used, too, in the treatment of facial fractures, especially where the jaws are involved (Panuska and De Dolph 1965).

Halo traction offers a number of advantages. It may be used with a variety of counter-traction methods both in the recumbent and in the ambulatory patient. Application of the skull pins is simple. Infection at the pin sites is uncommon if the technique of application and the details of after-care are fully understood and carried out. The body jacket fixation allows easy walking and the femoral, pelvic and other counter-traction devices facilitate nursing on an ordinary bed, a side-turning bed such as the Stryker or Foster frame, or an end-over-end turning bed such as the circo-electric bed.

SUMMARY

1. The usefulness of the halo method of traction in orthopaedic surgery, neurosurgery and plastic surgery is not widely appreciated.
2. Modifications of the apparatus are described and the technique of application is detailed.
3. Some advantages of the method are discussed.

REFERENCES

- DePALMA, A. F., and McKEEN, W. B. (1965): Congenital Kyphoscoliosis with Paraplegia. *Clinical Orthopaedics and Related Research*, **39**, 190.
- FREEMAN, G. E., Jun. (1961): Correction of Severe Deformity of the Cervical Spine in Ankylosing Spondylitis with the Halo Device. *Journal of Bone and Joint Surgery*, **43-A**, 547.
- GARRETT, A. L., PERRY, J., and NICKEL, V. L. (1961): Stabilization of the Collapsing Spine. *Journal of Bone and Joint Surgery*, **43-A**, 474.
- HYNDMAN, O. R. (1947): Transplantation of the Spinal Cord. *Surgery, Gynecology and Obstetrics*, **84**, 460.
- MOE, J. H. (1967): Complications of Scoliosis Treatment. *Clinical Orthopaedics and Related Research*, **53**, 21.
- NICKEL, V. L., PERRY, J., GARRETT, A., and SNELSON, R. (1960): Applications of the Halo. *Orthopedic and Prosthetic Appliance Journal*, **14**, 31.
- PANUSKA, H. J., and DE DOLPH, T. H. (1965): Extraoral Traction with Halo Head Frame for Complex Facial Fractures. *Journal of Oral Surgery*, **23**, 212.
- PERRY, J., and NICKEL, V. L. (1959): Total Cervical-Spine Fusion for Neck Paralysis. *Journal of Bone and Joint Surgery*, **41-A**, 37.
- SCHNEIDER, R. C. (1960): Transposition of the Compressed Spinal Cord in Kyphoscoliotic Patients with Neurological Deficit. *Journal of Bone and Joint Surgery*, **42-A**, 1027.
- SIMMONS, E. H. (1968): *Personal communication*.
- WELPLY, W. R. (1966): Fractures and Dislocations of the Cervical Spine. *Manitoba Medical Review*, **46**, 175.