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HALO-BODY DEVICE

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Summary. A halo-body system is described which has been developed at Princess Margaret Rose Orthopaedic Hospital in Edinburgh. The system is easy to apply and consists of a standard halo, linked to malleable plates by two hollow vertical rods. These rods are connected to the ring by swivel joints which allow for the movements of flexion and extension. The malleable plates are incorporated into the plaster jacket which rests upon the iliac crests.

The results of 13 patients who have had this system applied are discussed and include patients who have sustained fractures of the cervical spine or who have had bone destruction from metastatic disease or from infection.

Using this type of system there have been few complications and the patients have benefitted from easy mobilisation.

Key words: Halo-body fixation system; Indications for use; Advantages; Application.

Introduction

PERRY AND NICKEL introduced the halo system in 1959 for the treatment of patients with poliomyelitis. However, James (1960) from this hospital was the first to report on its use for treating patients with a fracture of the odontoid process. Since then there has been an increasing interest in the application of such an apparatus.

The original designs were fairly cumbersome and have been simplified with the passage of time. Cooper *et al.* (1979) presented their results using the halo-vest for the treatment of patients with cervical spine injuries, laying emphasis on the application of the vest to incorporate the halo, rather than using a jacket to rest on the iliac crests as was originally described.

In this paper we wish to present the results of the halo-body fixation system which has been developed in our hospital. The difference with this apparatus is that it is both simple to apply and adjust whilst the jacket rests upon the iliac crests, thus ensuring stability in the system.

Method

a) The Halo-Body Device:

The halo consists of a standard single size stainless steel ring which has two 50 mm long stainless steel horns attached centrally on each side. The ring is perforated to allow for four threaded screws to be fixed to the skull.

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FIG. 1
Halo-body system with vertical struts.

FIG. 2
The movement that can occur at the swivel joints.

This ring is linked to malleable plates, which are incorporated into a plaster jacket, by means of hollow vertical struts containing a threaded rod (Fig. 1). The plaster jacket may be made of any material.

The rod allows for adjustments in the height of the shoulder rests and the halo while also allowing for the movements of flexion, extension as well as rotation at the joints (Fig. 2). A certain degree of rotation is also permitted at the swivel joints which link the vertical struts with the shoulder rests. These planes of movement are needed when applying the device.

b) Assembly and application:

It is our current practice to first apply a well fitted jacket using the Oxford Cottrell table. This enables the patient to be suspended horizontally by the shoulders and buttocks leaving the trunk completely free to apply the cast. The jacket extends from the thorax to well below the iliac crests and is attenuated over the iliac crests, as for a Milwaukee brace, in order to prevent the jacket from riding up.

FIG. 3

A patient with the halo-body system on; the jacket rests on the iliac crest.

FIG. 4

A side view of the patient, the jacket does not rest on the shoulders.

When the cast is set the halo is then applied, without general anaesthesia, unless the fracture requires manipulation. The ring is aligned against the skull using four localising pins with flat discs. The four threaded pins are then inserted into the vertex of the skull and tightened with a torque screw driver, set at a 6lb per sq in. The nut washers are secured and the shoulder pieces, connecting the bars and vertical struts are linked together and incorporated into the jacket (Figs. 3 and 4).

Adequate psychological preparation of the patient prior to application of the halo-body device is essential in order to ensure that he is able to accept the alteration in his body image which is imposed by the device. A full explanation is given of how it is applied and photographs of another patient in the device are shown.

Because the neck is held rigidly the patient can be safely and confidently mobilised, usually within 24 hours of application and the risk of complications arising from prolonged bed rest are therefore minimised.

Support and advice from other members of the staff, including physiotherapists, occupational therapists and the community nurses ensure that

the patient can return to independence within the restrictions of the halo-body device, and be discharged home.

Results

Since 1980, 13 patients have had the halo-body device applied, and are included in this study. The indications have been acute injuries with unstable fractures of the cervical spine in eight and instability of the cervical spine due to infection or metastatic disease in five.

a) Fractures

Amongst those with cervical spine injury, caused either by a road traffic accident or a fall from a height there were six males and two females with a mean age of 36 and a range from 19 to 66 years. The sites involved are shown in Table I. The patients with odontoid process fractures were both under 40 years of age and the degree of displacement was less than 4 mm. In only three patients were there any associated neurological findings Table II. In addition to the halo-body, three patients had posterior cervical fusions within the device.

The halo-body was left on in the patients for 6 weeks and they were then placed in a four poster collar which they wore for twelve weeks and finally a soft collar was applied for a further 6–12 weeks. These patients have all been followed up for a minimum of 6 weeks (the one patient who died) with a mean follow up of 15 months.

All the patients tolerated the device and were trouble free within the system, mobilising early and leaving hospital on average at 3 weeks, except for the patient with paraplegia who was transferred to the spinal injuries

TABLE I

Fracture	Number of patients
Odontoid process	2
Body of C2	2
Fracture dislocation C _{2/3}	2
Fracture dislocation C _{6/7}	2

TABLE II
Associated neurological findings

Finding	Injury	No. of patients
Weak right triceps MRC 4	Fracture dislocation C _{6/7}	1
IV Cranial nerve palsy	Fracture of odontoid process and minor head injury	1
Transection of spinal cord at T ₆	Fracture of odontoid process Fracture dislocation T _{5/6}	1

unit, and the patient who died. This man was aged 66 years, he had a C₆ on C₇ fracture dislocation, following a road traffic accident. There was no neurological involvement, but he had diabetes mellitus. Following reduction of his fracture by skull traction he was placed in a halo-body device and was allowed to mobilise. He was sent home at 3 weeks but was readmitted with septicaemia and died from aspergillosis involving the lung.

The seven other patients were assessed at follow up for union of their fracture, freedom from pain and degree of cervical spine movement. Two of these patients had reduction of cervical spine movement but none had pain and their fractures all appeared to be radiologically united.

b) Bone Destruction

In the five patients who have had the system applied to stabilise the cervical spine, four had extensive bone metastases from carcinoma of the breast. Two of these patients underwent radiotherapy and three had both anterior and posterior cervical fusions while in the system. Three of the four patients have since died from their disease, however the quality of their life appeared to be improved, all three surviving for between 7 months and 14 months after application of the device.

In these patients the halo jacket was left on for the period of the operation and removed as soon as it was felt that the anterior and posterior constructs were effective. This was about 6 weeks.

However, the patient with infection of the cervical spine had instability following infection from previous anterior and posterior fusions. The device was left on for an 11 week period and the patient tolerated it without difficulty, union eventually occurring. In one patient loosening of a threaded pin required re-application of the jacket and refitting of this pin. This problem arose because the jacket was not resting on the iliac crests.

Discussion

The Princess Margaret Rose Orthopaedic Hospital Halo-Body device is developed from other devices, namely the Perry and Nickel system. However it has certain distinct advantages because it is both easy to apply and has great flexibility, the swivel joints allowing for rotation and the rods allowing for distraction. It is clear that if this device does not rest on the iliac crests, then the halo will become loose. Nickel, Perry and Garrett (1968) laid down six conditions which they considered were required for the successful halo apparatus:

1. Precise control of the position of the cervical spine in 3 planes.
2. Progressive and adjustable longitudinal traction.
3. Rigid stabilisation.
4. Simple application.
5. Freedom from complications during the prolonged period of use, which is necessary for spinal fusion.
6. Minimum discomfort.

We believe that this device goes a long way to fulfilling such criteria.

The halo-body systems for treating cervical spine injury have become an established method, particularly for Hangman and Jefferson type

fractures and for most fractures of C₃ to C₇. Odontoid fractures can be treated by this method in patients under 40 years where the displacement is less than 4 mm (Cooper *et al.*, 1979), but early posterior cervical fusion may be the treatment of choice in older patients with more significant displacement Ekong *et al.* (1981). There were no pure ligamentous injuries in this group, but clearly these patients are best treated with early fusion.

The incidence of complications appears to be low suggesting that fairly rigid fixation is achieved and that there is little movement at the pin tract site.

The death from aspergillosis was salutary and death from chest infections is recorded in other series, Ekong *et al.* (1981). Our practise now is not to use these systems in older patients who have a tendency to chest infections.

The halo-body device was found to be a useful system in which to undertake cervical spine surgery, particularly in patients with gross bone destruction for metastatic disease.

RÉSUMÉ

On décrit un système auréole-corps qu'on a développé à l'Hôpital Orthopédique Princesse Margaret Rose à Edimbourg. Le système est facile à appliquer et consiste d'une auréole standard, reliée à des plaques malléables par 2 tiges verticales creuses. Ces tiges sont reliées à l'anneau par des joints à rotule qui tiennent compte des mouvements de flexion et d'extension. Les plaques malléables sont incorporées dans le corset plâtré qui repose sur les crêtes iliaques.

Les résultats de 13 malades à qui on a appliqué ce système sont discutés et leur nombre comprend des malades qui ont souffert la fracture de la vertèbre cervicale ou qui ont subi la destruction des os à la suite de la maladie métastatique soit de l'infection.

En employant ce système on a rencontré peu de complications et les malades ont profité d'une mobilisation facile.

ZUSAMMENFASSUNG

Man beschreibt ein Halo-Körpersystem, das man in dem Prinzessin Margaret Rose Orthopädischen Spital in Edinburg entwickelt hat. Das System ist leicht anwendbar, und besteht aus einem an schmiedbare Platten durch 2 hohle, senkrechte Stangen angebundenes Standardhalo. Diese Stangen sind an den Ring durch Drehgelenke angebunden, die Dreh- und Ausdehnungsbewegungen berücksichtigen. Die schmiedbaren Platten sind in das Gipskorsett, das auf den Beckenkämmen ruht, eingebaut.

Die Ergebnisse von 13 Patienten, bei denen man dieses System angewendet hat, werden diskutiert, und diese schliessen Patienten ein, die eine Halswirbelfraktur gelitten haben, oder die eine Knochenzerstörung durch metastatische Krankheit bzw. durch Infektion erfahren haben.

Bei Anwendung von dieser Art System hat es wenige Komplikationen gegeben, und die Patienten haben den Nutz der leichten Mobilmachung daraus bekommen.

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