Abstract

**Purpose.** Occipitocervical fusion is required when the occipitocervical joint is unstable. The purpose of this paper is to discuss the role of imaging in the pre- and postoperative evaluation of posterior occipitocervical fusion (POCF), focusing on contoured loop fixation by Hartshill and Songer instrumentation.

**Materials and methods.** We studied 21 patients (eight males, 12 females; age range 6–70 years; mean age 32.6 years) with craniocervical instability who underwent POCF with Hartshill U-shaped rod and Songer sublaminar wires. Pre- and postoperative radiographic, computed tomography (CT) and magnetic resonance (MR) imaging examinations were performed in all patients. A 3-to 6-month period of external orthosis with halo vest, sterno-occipital-mandibular immobiliser (SOMI) brace or Philadelphia collar followed surgery. Follow-up was 12–96 (mean 53.1) months.

**Results.** Clinical assessment using the Frankel scale revealed improvement or deterioration arrest in all but two patients: one with C3 failure and halo destabilisation; the other, who had exhibited myelopathy signs on preoperative MR imaging and persistent basilar impression, showed increasing and progressive neurological deficits despite successful POCF.

**Conclusions.** Pre- and postoperative imaging is extremely useful in patients scheduled to undergo POCF. Preoperative MR screening of basilar impression associated with possible spinal cord lesions appears mandatory to predict possible deterioration and prevent undesired failure of the fusion.

Riassunto

**Obiettivo.** L'intervento di artrodesi occipito-cervicale posteriore (AOCP) è indicato nelle instabilità della giunzione cranio-cervicale. Scopo di questo lavoro è stato quello di valutare il ruolo dell'imaging pre- e post-operatorio nella AOCP, puntando l'attenzione sul posizionamento, per via posteriore, di fili sublaminari di Songer e barra a U di Hartshill.

**Materiali e metodi.** Sono stati studiati 21 pazienti (8 uomini, 13 donne; range d'età, 6–70 anni; età media, 32.6) con instabilità cranio-cervicale e sottoposti ad AOCP con posizionamento di barra ad U di Hartshill e fili sublaminari di Songer. Tutti i pazienti sono stati sottoposti ad esame radiografico, tomografia computerizzata (TC) e risonanza magnetica (RM) pre- e post-operatori. Dopo chirurgia, i pazienti sono stati trattati per 3–6 mesi con ortosi esterna (tutori Halo, Philadelphia o sterno-occipitali-mandibulari [SOMI]). Il follow-up è stato di 12–96 mesi (media, 53,1 mesi).

**Risultati.** La valutazione clinica, secondo la scala di Frankel, ha mostrato un miglioramento clinico o un arresto del deterioramento clinico in tutti i pazienti, tranne due. In uno di questi due pazienti, si è avuta una frattura di C3 con destabilizzazione dell’Halo; l’altro paziente, con segni di mielopatia all’esame RM pre-operatorio e con persistenza d’impresso basilaris, ha mostrato un progressivo peggioramento dei deficit neurologici nonostante una corretta AOCP.

**Conclusioni.** L'imaging pre- e post-operatorio è molto utile nei pazienti candidati ad AOCP. Lo screening RM pre-
operation, and it may suggest the need for an alternative surgical approach, such as the transoral approach.

**Keywords** Craniocervical junction · Instability · Radiography · CT · MR imaging

**Introduction**

The craniocervical junction allows movements in flexion, extension and rotation; its stability is mainly ensured by the anatomical and functional integrity of ligamentous structures, the most important being the tectorial membrane, the alar ligaments and the transverse fibres of the cruciform ligament (transverse ligament) [1]. Craniocervical instability may develop as a result of several pathological conditions, including: trauma, inflammatory arthritis, tumour, infection, extensive laminectomy, developmental abnormalities or skeletal dysplasia [2]. Posterior occipitocervical fusion (POCF) is one of many surgical techniques available for treating craniocervical instability. These techniques, which date back to the Egyptian pharaohs [3], have undergone numerous innovations in recent decades [4–12]. The evolution of surgical techniques is largely related to the advent of noninvasive imaging methods, such as computed tomography (CT) and magnetic resonance (MR) imaging, which – by permitting accurate anatomical evaluation of the craniocervical region – help the surgeon to choose the most appropriate surgical approach and technique to obtain optimal craniocervical fusion [13].

The purpose of this study was to define the role of pre- and postoperative imaging in patients undergoing POCF, focusing on Songer sublaminar wires and Hartshill U-shaped rod placement via a posterior approach.

**Materials and methods**

Between January 1999 and March 2008, 21 patients with craniocervical instability (eight males, 13 females; age range 6–70 years; mean 32.6) admitted to our Department of Neurosurgery, were treated with POCF, which involved placing Songer sublaminar wires and a Hartshill U-shaped rod. All patients or their parents provided written informed consent for participation in this study. Nine of the 21 patients (two male and seven female; age range 6–14 years; mean 9.1) had craniocervical instability secondary to Down syndrome (patients 9, 10, 13, 15, 16, 19), Morquio syndrome (patients 7,