

## **Invasive Cervical Traction Under Fluoroscopic Guidance for Closed Reduction of the Odontoid Process**

Invasive cervical traction (ICT) is a definitive test for establishing the diagnosis of craniocervical instability with functional cranial settling. Currently available radiographic studies including cervical MRI and flexion/extension X-rays are not sufficient to make the diagnosis. Typical candidates for ICT are patients with symptoms and signs of lower brainstem dysfunction occurring in association with the following conditions: failed Chiari surgery; hereditary disorders of connective tissue (e.g., Ehlers-Danlos syndrome, MASS phenotype, Marfans syndrome); rheumatoid arthritis; osseous disorders of the craniocervical junction; and posttraumatic whiplash injuries.

**Technique:** ICT is performed in the operating room under strict medical supervision. Patients are anesthetized briefly using MAC and cranial tongs and implanted under local anesthesia. After awakening, the patient is placed in a sitting position in a hospital bed with an overhead frame and a pulley system. The head is extracted upon the neck in neutral position with 5° extension using graduated weights under fluoroscopic guidance. With each 5 lb. increment, the patient's presenting symptoms, neurological findings, and fluoroscopic anatomy of the craniocervical junction are recorded and entered into a database. Patients with highly positive ICT tests typically experience a complete relief of symptoms and signs at a specific extraction weight that correlates with anatomic findings such as reduction of the odontoid tip within the ring of C1 and reduction of the C1 arch below the base of the skull that can be measured precisely.

**Objective:** The goals of ICT are as follows: (1) to establish or rule out the diagnosis of craniocervical instability with functional cranial settling; (2) to identify patients who do not require craniocervical fusion, thereby avoiding an unnecessary surgical step; (3) to identify patients who are potential candidates for craniocervical fusion - in extraction and (4) to acquire precise radiographic and extraction weight measurements that can be reproduced at the time of the craniocervical fusion to maximize the likelihood of optimal outcome. It is TCI policy that all patients with clinical suspicion of craniocervical instability/functional cranial settling undergo ICT prior to surgery.