1.1 Introduction

Among the determinants of the success of a surgical technique are an in-depth knowledge of the surgical anatomy, the combining of the expertise of the different professionals, and the availability of dedicated instruments and tools, which permit advances to take place in terms of expanding the indications, improving the results and reducing the complications.

Advances in surgical instrumentation, in hemostatic techniques and materials, and in image guidance systems, and, most importantly, collaboration between neurosurgeons and otolaryngologists/head and neck surgeons/maxillofacial surgeons, together with the contribution of new imaging devices and techniques, have resulted in recent dramatic changes in the practice of skull-base surgery, ultimately resulting in a movement toward less-invasive procedures, as in most fields of modern medicine.

If on one hand such technological advances push the development of new surgical techniques, the opposite is also true: the introduction of a novel surgical approach or technique often requires the design and refinement of new dedicated instruments and tools, contributing to the mutual relationships between surgeons and biomedical engineers and manufacturers.

Surgery of the skull base is amongst the most difficult, complex and, at the same time, rewarding experiences. Skull-base surgery does not just require the acquisition of perfect surgical skill: surgeons also need to acquire a thorough knowledge of anatomy, mastery of the pros and cons of all the materials and instruments to be used during the operation, the ability to share his/her peculiarities with others, versatility in choosing among the different approaches (transcranial, transfacial, combined transcranial–transfacial, etc.), and knowledge of the pros and cons of each one of them, etc [1, 2].

This chapter focuses on one of these aspects: the possibilities and limitations of the main instruments and tools used during most of the surgical approaches described in the following chapters throughout the book.

1.2 Types of Instrument

There are two types of instrument in skull-base surgery: instruments with a single shaft and a functional tip (for example, hooks, dissectors, curettes, knives, etc), and those that fall within what the instrument manufacturers call the “forceps family” (for example bipolar forceps, tumor-holding forceps, biopsy rongeurs, vascular forceps, and scissors). Some approaches, e.g. the transsphenoidal approaches, performed under certain conditions such as endoscopy, demand dedicated instruments [11].

There are very different principles involved in handling and using these two groups of instruments. It is possible to hold the single-shaft instruments anywhere along the shaft. Where the instrument is grasped depends on the working depth, i.e. the distance between the tip of the index finger and the tissue plane being dissected. Instruments of the forceps group are very different. They are made with a definite area to grasp the
instrument and to control the opening and closing action of the tips.

The design of microsurgical instruments should incorporate stability, flexibility, and mobility. Their use in microsurgery can be compared to that of a pencil during writing. The forearm is supported on a specifically designed rest. The hand is then free and relaxed and is supported at the surface edge of the wound by the fourth and fifth fingers. The instrument is grasped and controlled using the index and middle fingers, together with the thumb. From the opening of the dura until it has been closed by suturing, the operation is performed under the operating microscope and/or the endoscope. During this time the surgeon mainly uses the bipolar forceps and suction tip.

1.3 Microscope

Microsurgical techniques, which require the use of the operating microscope, are a key part of skull-base surgery and the acquisition of skill and proficiency in the use of the mobile operating microscope is the first step in microsurgery [3, 4].

The operating microscope, which as well as magnifying improves illumination and provides stereoscopic and telescopic vision, is the key instrument in the microsurgical treatment of intracranial lesions. The magnification, which is variable between ×3 and ×25, is ultimately derived from the optical relationship between the objective lens, the side of the binocular tubes, and the magnification of the eyepieces. Besides magnification, the unique characteristic of the microscope compared with the other surgical visualizing tools, such as the endoscope, is its most useful function, stereoscopic 3D vision. This function, coupled with the zoom capabilities of the optical system, brings the plane of the operative field closer to the observer, maintains the optical capacity of depth perception, and allows the surgeon to work bimanually.

The degree of illumination depends upon the light source used, on the degree of magnification (the greater the magnification, the less the passage of light), and on whether a beam splitter for the attachment of observation tubes and camera equipment is employed.