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Technical Note

Clinical experience with a high definition exoscope system for surgery of pineal region lesions

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ABSTRACT

VITOM-90 (Karl Storz Endoscopy, Tuttlingen, Germany) is a new technology that can be used as an alternative to the operating microscope. We have found that this device substantially improves surgeon comfort during infra-tentorial supracerebellar approaches to pineal region masses, and now report our experiences. The VITOM-90 is a specially designed scope that is attached to a high definition (HD) digital camera and displayed on a HD video monitor. This system was utilized in five patients undergoing infra-tentorial supracerebellar approaches for pineal region lesions. Surgical outcomes and pathologies are described. The device was used by three surgeons during five procedures. Three patients underwent surgery in the sitting position and two in the modified prone (Concorde) position. Pathologies included pineocytoma, lipoma, and germinoma. Total resection was achieved in three patients and subtotal in two patients. Surgeon assessment was positive; surgeons indicated that surgery with the VITOM-90 was more comfortable than with the operating microscope. Lack of stereopsis was considered a minor drawback. The VITOM-90 permitted a natural head and neck position. Operating room personnel and residents reported improved visualization of the anatomy. Using the VITOM-90 benefited surgeons during pineal region surgery by reducing strain and allowing the surgeon to operate from a comfortable position without increased operative time or complications. The improved comfort levels may translate into safer, more accurate surgeries in this complex area.

1. Introduction

There are several neurosurgical operations performed via a suboccipital craniotomy in which patient positioning can often require the surgeon to contort into uncomfortable positions for prolonged periods of time. Perhaps most demanding of these operations is the infra-tentorial supracerebellar [1–5] approach to the pineal region, which utilizes a corridor below the tentorium cerebelli and above the cerebellum to access the pineal recess. The natural anatomy of this corridor takes a caudal to rostral trajectory that creates a number of technical issues related to positioning and field of view that can make it a difficult technical endeavor. Technical constraints include surgeon head position, microscope position, length of surgeon reach, and fatigue. To overcome these obstacles, four patient positions have been described, namely the sitting, lateral, prone and modified prone (Concorde) positions. The choice of position is typically based on the location of the surgical lesion and surgeon preference, but none completely eliminate technical issues arising from positioning.

A recent advent in operative imaging technology is the "exoscope," a rigid rod lens system that looks and functions much like standard endoscopes but has a long focal distance of 25–30 cm, and therefore is positioned outside the surgical cavity. The exoscope is positioned with a mechanical or pneumatic scope holder that permits rapid repositioning and refocusing. The device has been termed the "Video Telescope Operating Microscope" (VITOM; Karl Storz Endoscopy, Tuttlingen, Germany). The image quality is similar to that of the operative microscope but provides improved depth of field of view, thereby minimizing the need to refocus the scope at higher magnifications [6,7]. Because visualization is performed from a video monitor, the surgeon is able to operate from a comfortable position with minimal strain on the neck or arms, thereby reducing surgical fatigue or end-point tremor. We have previously reported our surgical experiences with this system in spinal surgery [8] and in limited aspects of intracranial surgery [7].

We have discovered that the most recent version of the VITOM, the VITOM-90, offers several advantages over the operating microscope for surgery in the pineal region and posterior fossa. We now

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report our clinical experience with the VITOM-90, used during suboccipital craniotomies for pineal region masses.

2. Materials and methods

2.1. The VITOM-90 system

Detailed descriptions of the VITOM and some clinical applications have been reported [6]. VITOM is a telescopic camera that produces very high quality video images with 16 times magnification, and a mean object distance of 30 cm. A newer version of this system, VITOM-90, utilizes a mirror to allow the long axis of the rod-lens telescope to sit at a right angle from the distal objective, while fully integrating a dual channel xenon light source and cable. The scope can be positioned in almost any direction to avoid interference with surgeon field of view or manual dexterity. The original VITOM had to be placed in a direct line of sight with the surgical corridor, however, with the VITOM-90, only the camera portion of the device has to be placed in the surgical corridor.

The VITOM-90 consists of a rigid lens telescope, camera head, light source, and video display monitor as described below (Fig. 1A).

2.1.1. Telescope

The telescope is an autoclavable rigid lens telescope (Karl Storz Endoscopy, Tuttlingen, Germany) with a 10 mm outer diameter and shaft length of 14 cm. Unlike the initial VITOM, the VITOM-90 head is configured to sit at 90 degrees from the long axis of the main telescope. These modifications allow the surgeon to position the scope so that direct line of sight with the video monitor is not obstructed, and freedom for manual manipulation of surgical instruments is maximized (Fig. 1B).

2.1.2. Video display and documentation

A medical grade 23 inch high definition (HD; 2 million pixels) video monitor is used (NDS Surgical Imaging, San Jose, CA).

2.2. Clinical material

Five patients harboring mass lesions in the pineal region underwent surgery via an infratentorial supracerebellar approach. Each patient's operative planning was made independently of the decision to use the VITOM-90. Both the standard operating microscope and VITOM-90 were available to the surgeon at all times, and were used at the discretion of the surgeon. During the microdissection portions of the procedure, the VITOM-90 was utilized in place of the standard operating microscope. Two patients underwent surgery with the patient in the modified prone (Concorde) position, while three were operated on in the sitting position. Surgeon qualitative assessment of visual quality, ease of use, and overall comfort level was measured by interview with the primary surgeon

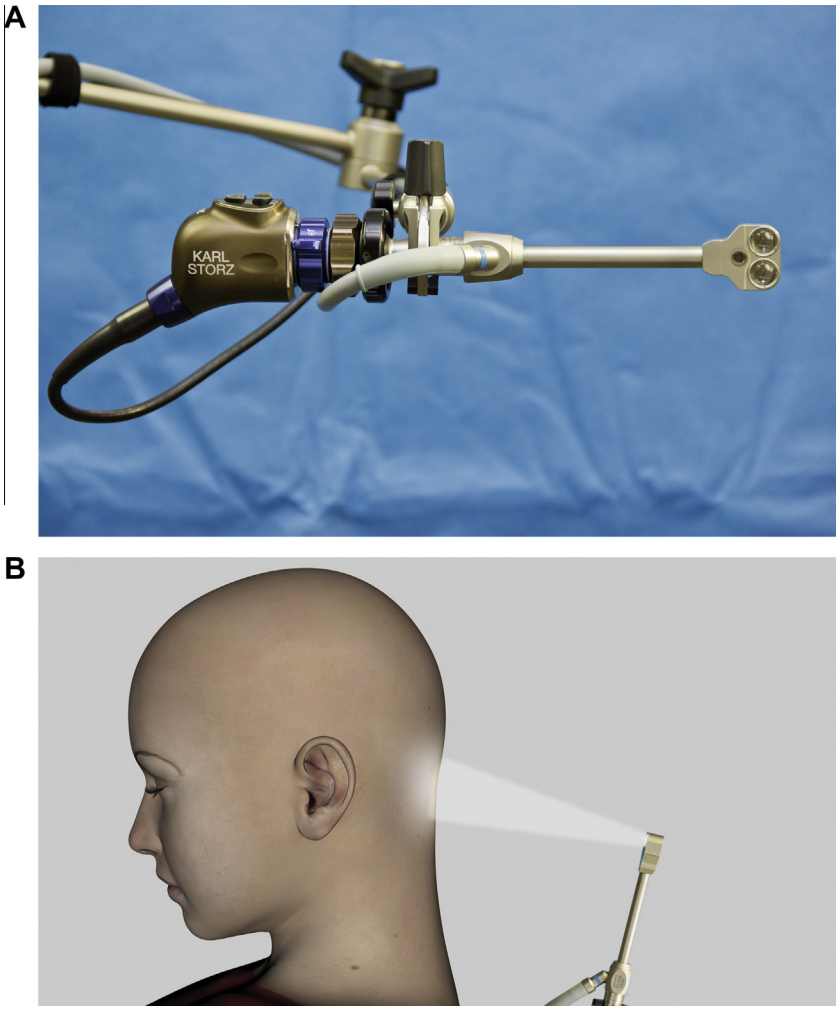

Fig. 1. (A) The VITOM-90 (Karl Storz Endoscopy, Tuttlingen, Germany). (B) Diagram of the positioning of the exoscope during surgery in the sitting position, lateral view. The scope is positioned 30 cm from the desired focal point.