Neurosurgical endoscopy using the side-viewing telescope

Technical note

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The authors report their application of the Hopkins telescope to various neurosurgical procedures, and describe the technique and advantages of its employment.

KEY WORDS • Hopkins telescope • aneurysm • pituitary tumor • lumbar discectomy • endoscopy

Visualization of areas that are out of the direct line of vision is highly desirable in neurosurgical procedures. Recently, others have employed a pharyngeal mirror and a ventriculofiberscope in an effort to solve the problem of obscure angles of visualization. We have applied the Hopkins side-viewing telescope* with a 70° and 120° angular vision to various neurosurgical procedures and have found it valuable.

Description of the Instrument

Technical departure from the traditional design of endoscopic instruments was made by Hopkins in his development of a rod-lens system. Instead of an in-line series of small lenses with intervening air spaces, he used glass rods to replace the air space and small air spaces to replace the former lenses. The ends of the glass rods are shaped to the form of the lenses (Fig. 1).* This optical system produces a significantly larger viewing angle and greatly increased light transmission with exceedingly fine resolution. In addition, even a miniature version of the system gives exceptional performance. The viewing angle of the system was two to three times larger than conventional systems, depending upon distance from the object viewed, thus a much greater part of the field is seen in the single viewing field. This excellent field of vision makes orientation much easier and requires minimal manipulation of the instrument.

Light absorption through a traditional small telescope is very high, and this light loss limits the efficiency of most endoscopy units; however, the Hopkins unit has a higher percentage of light transmission resulting in a much brighter image. A significant step forward in obtaining improved illumination was provided by Lamm with the development of small flexible fiberglass threads for the transmission of light. Because of the small diameter of the Hopkins lens system, it is

*Hopkins side-viewing telescope manufactured by Storz Instrument Company, Tuttingen, West Germany.
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possible to place a thin layer of light-transmitting optical fiber bundles around the rod lenses to increase cold-light illumination without occupying a significant space within the endoscope itself. Application of the fiber bundles in conjunction with the Hopkins system provides the ideal combination of cold, intense illumination with a superior light-transmission system (Fig. 2).

The 70°-angle telescope, which can be obtained either 30 or 17.5 cm in length, and 2.7 and 4 mm in diameter, provides a visual field of 90°, of which 15° is retrograde (Fig. 2 B). At the same time, the system provides an infinite depth of field. At 1 mm from the object being viewed, 10-power magnification is effected, at 15 mm a 1:1 ratio of actual object size is appreciated. At intermediate distances, a linear relationship exists between distances and levels of magnification. The 4-mm diameter telescopes are also available with a 120° angle, which permits visualization not only to the side, but backward as well (Fig. 2 C).

**Technique**

The telescope is used when angled visualization is required. The instrument may be employed in a number of fashions with regard to a light source: 1) The unit may be used in parallel with the operating microscope using the microscope light source as a fund of reflected light; 2) Reflected light from an operating headlight or overhead operating room lighting may be sufficient because of the light-intensifying characteristics of the Hopkins instrument; or 3) The fiber optic light source for the instrument may be used as an adjunct in the event that adequate reflected light is not present. In each case, an interface that is free from hemorrhage is necessary for adequate visualization.

**Discussion**

We have found the Hopkins telescope to be of great value in assessing regions which are visually inaccessible or potentially accessible only with excessive manipulation. We have employed it for the following neurosurgical procedures: 1) intrasellar procedures by either the transphenoidal or subfrontal approaches to assist with visualization for complete gland ablation or total tumor excision (Fig. 3 upper left); 2) aneurysm surgery in the vicinity of the circle of Willis with particular emphasis on the assessment of adequacy and accuracy of clip placement, especially in lesions of the apex of the basilar artery (Fig. 3 upper right); and 3) interspace visualization assuring radical excision of an intervertebral disc (Fig. 3 lower left).

In all of these situations, the side-viewing telescope has added a new safe dimension of appreciation of visually inaccessible regions. It enhances the precision and increases the safety of surgical procedures in such areas. On this basis, we consider the instrument to
be a valuable adjunct in the performance of selected neurosurgical procedures.

References

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