Balloon-assisted Endoscopic Brow Lift: Preliminary Experience

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Balloon dissectors are inexpensive, disposable devices originally designed to provide rapid, atraumatic development of the work space needed for endoscopic hernia repair. We sought to evaluate the utility of these devices for endoscopic brow lift. Cadaver testing (n = 5) was followed by clinical use with assessment of flap loss, dissection time, completeness of dissection, and, more subjectively, amount of bleeding and tissue trauma. Dissection time over the forehead was less than 3 minutes in all cases; the remainder of the procedure was completed in times ranging from 20 to 35 minutes. No partial or total flap loss was experienced (n = 12). Bleeding after dissection was minimal. Dissection was possible in either the subperiosteal (n = 7) or subgaleal plane (n = 5), creating a smooth optical cavity. Dissection advanced to nearly the orbital rims, leaving only nerve identification, muscle removal, and flap elevation/fixation to complete the brow lift. Balloon dissection devices allow rapid mobilization of tissue planes with a minimum of effort. The feasibility of using balloon devices to speed and simplify endoscopic brow lift dissection has been demonstrated. Their full utility must await the results of outcome studies in a larger clinical series and must be balanced against their cost.

Balloon dissection devices were initially developed for endoscopic herniorrhaphy procedures. These inexpensive, disposable devices were designed to provide rapid, atraumatic development of the work space needed for endoscopic visualization. Additional balloon designs have been used in other areas of surgery, including gynecology, urology, and plastic surgery. Most use of balloon dissectors in plastic surgery has been for dissection of the implant pocket in breast augmentation. This opens the loose areolar plane between the pectoralis major muscle and the chest wall or between the breast tissue and the pectoralis fascia. We sought to evaluate the utility of an appropriately shaped balloon dissector for the smaller but more difficult dissection encountered in endoscopic brow lift.

Material and Methods

Single-use, sterile, disposable balloon devices specifically fabricated for the anatomy of the brow area were used (GSI, Inc., Cupertino, CA). These devices incorporated a balloon approximately 6 x 12 cm in dimension mounted onto a guide rod. In its undeployed state, the balloon is rolled along its long axis into a cigar-shaped lozenge held in position under an introducer sheath (Figure 1). When the balloon is inflated with saline

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solution, it unrolls laterally to produce dissection by use of shear force against the adjoining tissue, separating the tissue layers.

The surgical technique used was conventional except for the method used to dissect the work space for endoscopic visualization. Three to five incisions were made in the midline, in line with the lateral limbus, and in the temporal scalp, all approximately 2 cm behind the hairline. Through the midline incision, the desired plane of dissection (subgaleal or subperiosteal) was identified, and a channel was created down the "safe zone" of the midline to the root of the nose. The balloon dissector was then inserted through the midline scalp incision, advancing it to position the tip of the introducer at the root of the nose. This positioned the balloon to produce dissection down to the level of the orbital rims (Figure 2). The sheath was removed, and the balloon was inflated with sterile saline solution. The balloon was unrolled from the central axis of the guide rod, laterally producing the desired dissection. This was continued until full inflation or adequate dissection was produced, whichever occurs first (Figure 3). The entire work space required for endoscopic brow lift was produced by this means. The balloon was then deflated and removed. Next, the endoscope was inserted for visualization during identification of the supraorbital and supratrochlear nerves. Once these were clearly identified, the corrugator and procerus muscles were removed. Full perioral release at the orbital rims was obtained by use of an elevator before fixation and closure.

Initial tests were performed in cadavers to familiarize the surgeons with device use, to define techniques, and to confirm appropriate balloon configuration (n = 5). Next, the balloons were used in endoscopic brow lift clinically. Patients with previous brow surgery were excluded. Both subperiosteal and subgaleal dissection were evaluated. Additional procedures were performed concurrently as requested by the patient (i.e., face lift, blepharoplasty). Assessment of flap loss, dissection time, and, more subjectively, bleeding and tissue trauma was made. Completeness of dissection and quality of the optical cavity were also examined.
Results

Dissection time over the forehead was less than 3 minutes in all cases; the remainder of the procedure was completed in times ranging from 20 to 30 minutes. No partial or total flap loss was experienced in this small group \(n = 12\). Bleeding after dissection was minimal. Dissection proceeded in the correct plane, creating a smooth optical cavity without any tissue shreds protruding into the field of view. Dissection was possible in both the subperiosteal \((n = 7)\) and subgaleal plane \((n = 5)\), although it proceeds more easily in the latter. Subgaleally, communication of the brow dissection plane with the face lift temporal dissection was possible by use of the balloon. Dissection advanced to nearly the orbital rims, leaving only nerve identification, muscle removal, orbital rim periosteal release, and flap elevation/fixation to complete the brow lift. Unilateral failure of the balloon to deploy was noted in two cases. No lacerations of the supraorbital or supra trochlear vessels or nerve were encountered.

Mild to moderate swelling was present, similar to that obtained with conventionally dissected endoscopic brow lift. Most patients experienced mild numbness in the forehead during the early period of swelling. Numbness did not extend beyond 2 weeks in any patient in this group. Brow elevation was unaffected by choice of dissection technique, being a product of completeness of periosteal mobilization at the orbital rims and success of fixation (Figure 4).

Discussion

Endoscopic brow lift poses new challenges for surgeons making the transition to the endoscopic modality\(^6,7\): access is limited, instruments are awkward, and the visual presentation of the operating field is disorienting. The procedure calls for precise work to be performed, removing fibers of corrugator muscle from between branches of the supraorbital nerve. To complete this portion of the procedure successfully, the surgeon must identify and preserve the supratrochlear and supraorbital nerves and any associated blood vessels. First, an adequate optical cavity for videoendoscopy must be created and maintained. Inadequacies in this initial step will contribute to difficulty in performing the more demanding subsequent steps of the procedure. Fatigue produced during the dissection or disorientation, if familiar landmarks do not readily appear, will likewise contribute to frustration and imprecision during the remainder of the procedure.

Balloon dissection offers several advantages over conventional techniques. Conventional dissection often produces a cavity with deviation from the desired plane or tatters of galea or periosteum that obscure the operative field. Balloon dissection produces a smooth plane of dissection that proceeds to the orbital rim. This obviates the need to complete the last few centimeters of dissection under endoscopic visualization, provides the advantage of speed, eliminates the experience required to open the space around the nerves without injuring them, and produces only a minimum of bleeding, enhancing visualization. In endoscopy it is far simpler to prevent bleeding than to stop it. Balloon dissection also offers a low workload means of producing rapid reproducible dissection regardless of previous endoscopic experience. This allows the surgeon to concentrate on the more demanding job of muscle removal and fixation. Tissue trauma is minimized as the balloon distributes the dissection force over a large surface area, gently stretching tissue layers apart. The risk of injuring a nerve during dissection or tearing the...
overlying skin flap is low, making balloon dissection a safer option.

The principal disadvantage of the technique is the added cost of a single-use disposable balloon device to the procedure. Time saved will provide some cost reduction but probably not enough to offset the cost of the balloon. Tearing the tissue layers during dissection of the introduction channel can produce an irregular work space, because the balloon propagates dissection in whatever plane it is placed in. Nonetheless, it is relatively easy to produce an introduction channel in this safe midline region. Incomplete deployment negates the advantages achieved with the balloon, thus requiring completion of the dissection conventionally.

Use of the balloon dissector in endoscopic brow lift is relatively simple even for the novice. Several rules must be observed to achieve the desired dissection. The introduction channel must be uniformly in the desired plane. The device should be inserted until the introducer tip is seated at the root of the nose, positioning the distal edge of the balloon at the orbital rims.

Balloon dissection devices allow rapid mobilization of tissue planes with a minimum of surgeon workload. Reduced operating time, tissue trauma, and bleeding could contribute to the goals of minimal swelling and rapid recovery. The feasibility of using balloon devices to speed and simplify endoscopic brow lift dissection has been demonstrated. Their full utility must await the results of outcome studies in a larger clinical series and must be balanced against their cost.

References


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