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# A novel technique with polypropylene endoport for minimally invasive, microscopic evacuation of intracerebral hemorrhage: illustrative case

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**BACKGROUND** Spontaneous intracerebral hemorrhage is a neurological condition with high rates of morbidity and mortality, which is treated by various surgical techniques that seek minimal parenchymal distortion and maximum evacuation of the hematoma.

**OBSERVATIONS** The advancement of technology has allowed the development of minimally invasive techniques, but the high cost of its equipment is a limitation for its practice in developing countries or third world countries. A new technique called MEP-BA by its acronym in Spanish (microscope, polypropylene endoport and Foley catheter, bipolar forceps and aspiration) is presented, which seeks optimal results with low-cost materials through a polypropylene endoport with a sterile disposable syringe and Foley catheter, allowing the creation of transcortical or transsulcal corridors for the total evacuation of the hematoma.

**LESSONS** The neurosurgeon must be a creator and innovator of neurosurgical techniques and equipment that allow procedures to be reproducible worldwide. The MEP-BA technique provides low-cost access through which it allows the use of aspiration and coagulation devices, minimizing brain damage and maximizing the safety and efficacy of intracerebral hematoma evacuation.

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**KEYWORDS** minimally invasive; intracerebral hemorrhage; endoscopy; surgical

Spontaneous intracerebral hemorrhage (ICH) represents 10%–15% of cerebrovascular accidents[1] and is associated with mortality rates above 40%, with severe functional impairment being the greatest sequela of survivors.[2] The main risk factors for ICH are systemic arterial hypertension and cerebral amyloid angiopathy.[3]

The treatment of ICH is medical and/or surgical, the latter presenting important advances, without yet determining the ideal procedure. The evacuation of the hematoma has benefits such as reduction of the effect of mass and brain herniation, control of intracranial pressure, and reduction of excitotoxicity and neurotoxicity caused by blood products.[4,5]

Surgical techniques for evacuation of the hematoma are diverse from craniotomy or craniectomy to minimally invasive evacuations by endoscopic or microscopic route.[6] Minimally invasive techniques are classified into two types: passive, using a puncture needle, and active through suction. The latter achieves a more complete and controlled evacuation by direct vision.[7]

A new minimally invasive technique is presented, active type, with a polypropylene endoport with a sterile disposable syringe and Foley catheter, called MEP-BA by its acronym in Spanish (microscope, polypropylene endoport and Foley catheter, bipolar forceps and aspiration) that aims to provide a safe, effective, economical, and reproducible option.

## Illustrative Case

A 50-year-old female with uncontrolled hypertension and hyperlipidemia, presented with drowsiness, right hemiplegia, and right-side neglect. She arrived at the emergency department with a Glasgow Coma Scale (GCS) score of 11 points, National Institutes of Health Stroke Scale (NIHSS) score of 20 points, and an ICH score of 2. Noncontrast brain computed tomography was performed that revealed a left frontoparietal intracerebral hemorrhage with a size of 50 ml without intraventricular extension. She underwent a minimally

**ABBREVIATIONS** GCS = Glasgow Coma Scale; HIHSS = National Institutes of Health Stroke Scale; ICH = intracerebral hemorrhage; MEP-BA = microscope, polypropylene endoport, and Foley catheter, bipolar forceps and aspiration.

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invasive evacuation of microscopic ICH with a polypropylene endoport and a plus bipolar Foley catheter and aspiration. The planning of the trajectory was done with the method of the two points in the tomography (Fig. 1A–C).

The patient had a notable improvement to an NIHSS 8 and a 14-point GCS score on the first postoperative day and continued to improve during her hospitalization (Fig. 1D–F). She did not require mechanical ventilation. She was discharged on the tenth postoperative day with an NIHSS of 2. At 3-month follow-up the patient did not present any neurological deficit with NIHSS of 0.

## Operational Technique

The criteria for the selection of patients are the typical ones for evacuation by neuroendoscopy: volume greater than 20 ml, GCS and NIHSS scores greater than 5, initial modified Rankin Scale score less than 4, and stability of the hematoma for at least 6 hours with expansion less than 5 ml.[8]

### Devices

The polypropylene endoport is created with 5- or 10-ml syringes, which have a diameter of 0.55 and 0.59 inches, respectively, a number 14 or 16 Foley catheter, and a number 21 or 24 scalpel (Fig. 2). The syringe is prepared in length according to the depth of the hematoma, with the sterile scalpel on the surgical table, making the cut transversely and without leaving rough edges. The Foley catheter is prepared by removing the bladder-opening segment and leaving the balloon as the first segment. The Foley catheter is then inserted into the polypropylene endoport and inflatied until a dome forms at its exit port (Fig. 3). Once ready, it is introduced into the area of the corticotomy or transsulcal dissection.

### Planning

The location of the craniotomy is located on the brain computed tomography scan without contrast using the method of the two points:[9] the first point is placed in the center of the lesion (point A) and a second point where the lesion is closer to a cortical surface (point B; Fig. 1A and B). A straight line is drawn from point A to point B and then extended to the skull, defining the optimal path to approach ICH.

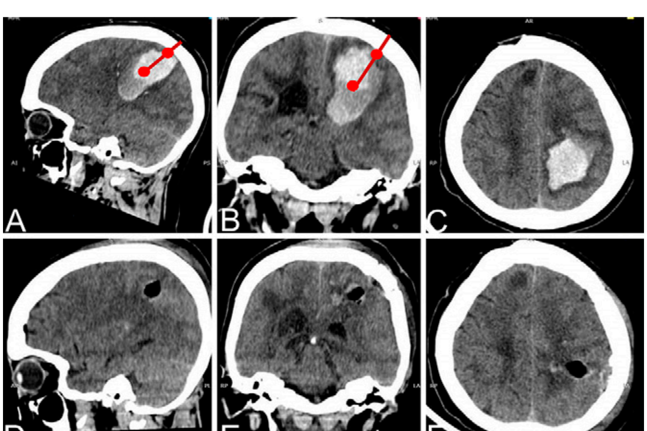


**FIG. 1.** Brain computed tomography without contrast. Preoperative sagittal (**A**), coronal (**B**), and axial (**C**) sections showing right frontoparietal intracerebral hematoma, in addition to planning using the two-point method. Postoperative sagittal (**D**), coronal (**E**), and axial (**F**) sections showing clean surgical bed without residual bleeding.

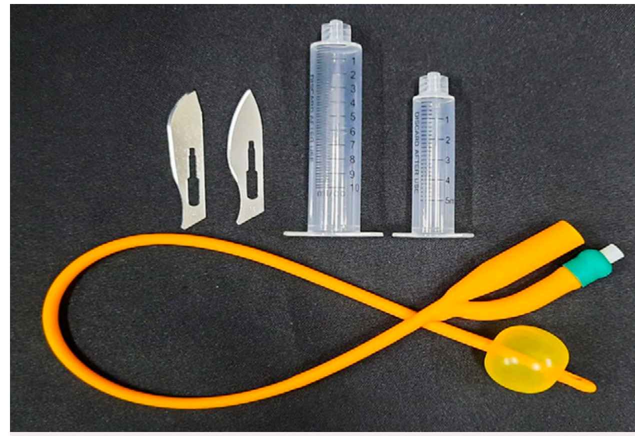

**FIG. 2.** Materials for MEP-BA technique. Scalpel number 22 and 24, polypropylene syringes of 5 or 10 ml without plunger, and Foley catheter number 14.

### Opening

A 4- to 5-cm horizontal or “S italic” skin incision is made with a scalpel, and a 5-mm round cutting bur is used to create a 3-cm–diameter craniotomy. It must be taken into account when the trajectory is not perfectly perpendicular to the skull, so that the trajectory is adequate and maximum. Hemostasis of the craniotomy is achieved with bone wax. The microscope is then entered to coagulate the dura and make a safe durotomy, star or cross, with the 90-degree Hoen Dura Dissector and number 15 scalpel (Fig. 4).

### Phase 1: MEP

*Microscope*

The insertion point can be of two types: red insertion point, when part of the hematoma is evident on the cortical surface, and white insertion point when nothing is evident on the cortical surface. These points are most frequently located in a gyrus, where it coagulates and

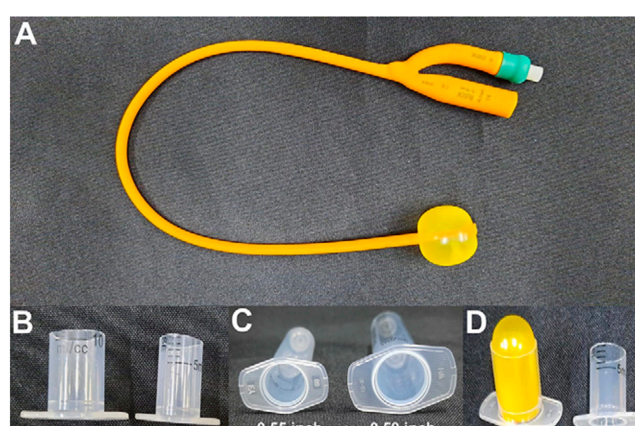


**FIG. 3. A:** Foley catheter prepared with inflated balloon. **B:** Custom-made polypropylene endoports. **C:** Measurements of the 5- and 10-ml endoports. **D:** Balloon inflated into the endoport, creating a dome in its proximal portion.

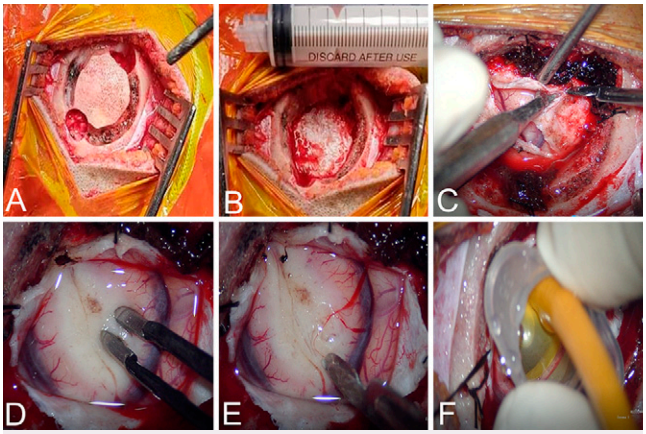


**FIG. 4. A:** Right parietal mini-craniotomy. **B:** Exposure of the dura. **C:** Cross durotomy. **D:** Bipolar coagulation in the entrance area. **E:** Arachnoid opening with a scalpel. **F:** Endoport placement.

a pial dissection plus corticotomy is performed, or in the transsulcal space, where a more anatomical dissection is performed, using the separation of the arachnoid membranes between the gyri.

*Polypropylene Endoport and Foley Catheter*

The polypropylene endoport together with the Foley catheter, previously prepared as shown in Fig. 3, is inserted into the planned path using the two-point method. When the support area of the endoport reaches the level of the craniotomy, the Foley catheter balloon deflates, leaving the endoport in the path of the hematoma. The vision of the microscope is directed toward the hole created to pass to the second phase.

Phase 2: BA

The hematoma is aspirated using a bimanual technique, with the left hand using Bayonet type bipolar forceps to detach and fragment the clots that were organized while performing controlled hemostasis, and with the right hand holding the suction instrument with vascular protector to remove fragmented clots or debris from the hematoma (Fig. 5). After all visible clots are aspirated, a second hemostasis is performed while scanning from distal to proximal. The cavity created by evacuation is passively infused with saline; if the solution is clear, it is covered with hemostatic material such as fibrillar Surgicel and hemostatic gel. The endoport is removed under microscopic vision.

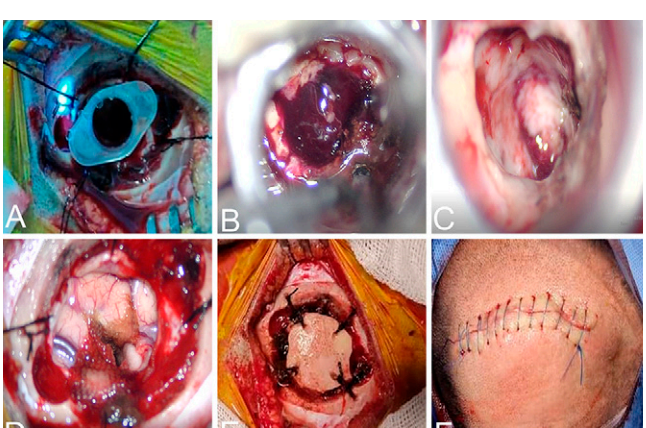


**FIG. 5. A:** Polypropylene endoport. **B:** Organized clots. **C:** Hematoma-free operative bed. **D:** Endoport removal. **E:** Placement of bone mini-platelet. **F:** Closure of the 5 cm linear incision, with nylon.

Closing

Polypropylene (Prolene; Ethicon) 5–0 is used to anchor the dural points and achieve a semihermetic closure and avoid any possible leakage of cerebrospinal fluid. The bone plate is replaced and anchored with 1–0 black silk. The galea and subcutaneous layer are closed with polyglactin (Vicryl; Ethicon) 3–0. Finally, the skin is sutured with subcuticular stitches or continuous stitches with 4–0 or 3–0 nylon, respectively.

## Discussion

Minimally invasive evacuation of the hematoma is a promising approach that will improve outcomes and survival.[10,11]

Advances in technology have allowed the development and popularity of minimally invasive evacuation through aspiration needles or endoports,[12] each with technical nuances, advantages, and disadvantages.[13] Studies suggest that these techniques may have better neurological outcomes compared to a standard craniotomy or craniectomy.[14,15] In addition to showing a lower rate of rebleeding after evacuation.[16,17]

### Observations

The MEP-BA technique is based on neuroendoscopic and microscopic strategies, being performed with low-cost supplies and daily use, such as 5- or 10-ml syringes and Foley catheter number 14, replacing the high costs of having an endoscope and video tower.

The uniqueness of MEP-BA is its ability to create an atraumatic channel and to be able to visualize and identify clots, evacuating them in a controlled and safe way, in addition to cauterizing the bleeding vessels or walls of the residual cavity of the hematoma in the second phase. The elementary principle of our technique allows minimizing brain distortion by creating a channel for the evacuation of the hematoma.

MEP-BA is also an option for developing or third world countries where resources are limited and have little financial support.

More research is needed to verify its performance or superiority over other minimally invasive alternatives.

### Lessons

Minimally invasive active evacuation techniques are feasible and safe, with the MEP-BA technique being a promising, fast, effective, low-cost, and reproducible option in any institution or hospital with limited resources.

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## Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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