USE OF ULTRASONIC ASPIRATION FOR DURAL OPENING IN RE-DO EPILEPSY SURGERY: A PRELIMINARY REPORT

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ABSTRACT

Dural detachment from the brain in cranial reoperations has been accomplished previously by selective coagulation and cutting of brain-dural adhesions. The results of ultrasonic aspiration during tumor surgery or brain cutting procedures led the authors to speculate that detachment of the duramater from the brain tumors by applying the Cavitron ultrasonic surgical aspirator (CUSA) to the brain-duramater interface could be used to reduce bleeding and facilitate dural opening during cranial re-operations. Thus, the use of ultrasonic aspiration and its effects on brain separation from the duramater were examined. Ten patients underwent a second craniotomy for epilepsy surgery (5 cases of extended temporal lobectomy and 5 cases of extended extratemporal lesionectomy). Intraoperative use of the CUSA during dural opening produced immediate blanching of the duramater and enhanced visualization of the cortical surface without distortion of the brain anatomy.

Incremental dural opening and brain visualization is achieved by careful application of ultrasonic aspiration directly into the brain-dura limit, producing immediate regional dural devascularization. Use of this technique reduces cortical and dural bleeding and enhances the ease and effectiveness of brain visualization.

Key words: *Detachment, Duramater Re-do surgery, Ultrasonic aspirator.*

INTRODUCTION

Cavitron ultrasonic surgical aspirator (CUSA; Valleylab, Inc., Boulder, CO) has become a mainstay in the surgical armamentarium for removing selected tumors[1,3,4,6]. The level of irrigation, suction, and vibration of the cutting tip is determined by settings on the control counsel and a foot switch activates the unit. Its hand-guided titanium tip oscillates at 23 to 25 kilohertz (KHz) and disintegrates adjacent tissue, aspirating it continuously through a central channel[9]. The usual standard CUSA displacement is 10-350 microns[2].

The safe and effective resection of nervous tissue, particularly in epilepsy surgery, relies on excellent visualization and hemostasis. This is not always possible, especially when dealing with re-do surgeries, because of the duramater adherence to the nervous tissue. Duramater opening in these cases is often tedious and time consuming. Frequently, while reopening, there is vessel tearing that after coagulation may result in neurological deficit and distorts the subjacent brain anatomy. Our results with CUSA in duramater re-opening indicated that rapid devascularization could be accomplished by applying ultrasonic aspiration directly in the dura-brain interface while opening, reducing bleeding and facilitating brain visualization. We report our experience in ten patients who underwent ultrasonic aspiration during duramater re-opening for a second epilepsy surgery. Of the ten patients, five had temporal epilepsy and underwent a cortical EEG monitoring and a second extended temporal lobectomy. Other five patients had extratemporal epilepsy and underwent a second intraoperative EEG mapping and subsequent extended cortical resection.

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Technique

Cavitron ultrasonic surgical aspirator was used to detach the duramater from the cortical surface. After initial incision of the duramater with an 11-blade, progressive dural opening was carried out circumferentially with Metzenbaum scissors. At this point, the CUSA tip was inserted in the brain-duramater interface and was turned on. The level of irrigation was 2-3 drops per second, level range of suction of 2 to 4, and vibration power range of the cutting tip of 6-8. The aspirator tip was moved in a stroke progressive manner all the way to the open circumference. The duramater border was held with Adson forceps or tacking sutures. When it was sufficient open space in the brain-dura interface, progressive dural opening was done in the usual manner and subsequent dural-brain detachment as described. To enhance dural devascularization and to limit cortical brain injury by the ultrasonic surgical aspirator we placed the aspirator tip by gently applied over the dural side of the brain-dura interface with a wiping movement. As well, further damage from the vibrating tip to the normal surrounding tissues was prevented by placing wet cotton patties or wet dressings at the cortical margin. The endpoint for ultrasonic aspiration at a specific site was a visible dural inner layer blanching. Eventual piamater to dural bridging vessels and tough fibrous tracts were coagulated and sectioned.

RESULTS

In all ten cases, slow direct ultrasonic aspiration to the dural side produced immediate blanching of the duramater and complete detachment from the brain cortical layer. In contrast, the portions of the brain that had not been detached with the CUSA bled actively during dural separation, requiring coagulation and further cortical anatomical distortion. The ultrasonic surgical aspirator applied over the dural layer in the cortical-dural limit rapidly detached both layers and without important bleeding. These features enhanced the ease and effectiveness of the dural opening in each instance and the procedure had no associated complications. Devascularization of the inner layer of the duramater and subsequent cortical detachment required only gently application of ultrasonic aspiration. In all cases, the cortical brain anatomy did not suffer an important deformation and none of the patients developed neurological deficits related to the procedure.

DISCUSSION

CUSA is a vibrating suction device that fragments and aspirates tumor tissue. These units have a control console that regulates the amount of irrigation and suction to the hand piece and the vibration of the cutting tip[1,2,5,6]. They are commonly used to debulk a neoplasm rapidly, after which the capsule is removed from nerves and vessels using fine dissecting instruments[2,3,6,10]. Other reported use is for nerve dissection in paroxysmal pain in patients with brachial plexus injuries, facial pain, phantom limb pain and intercostal neuralgia[8]. It is important to recall that these devices do not control bleeding, although some are designed to allow coagulation to be applied through the tip[1,4,6]. Despite the numerous advantages and disadvantages of ultrasonic aspirators[3,5-7,9,10], the potential for injury to cranial nerves or vascular structures remains a constant threat[6].

Direct ultrasonic aspiration effectively devascularized the regions of the duramater that had been attached to the brain, highlighting the potential of this technique to augment brain and duramater separation in cases of re-operation especially over eloquent areas. During dural detachment, in certain parts in which because of partial or complete bridging vessels or fibrous tracts to the dural inner layer or because of tortuous vessels or because a common feeding artery, was not possible to apply the CUSA, separation was done in the usual manner.

All our patients were epilepsy surgery candidates, and all had an uneventfully second supratentorial procedure with a clean dural re-opening by using this technique. As well, preservation of the normal cortical anatomy was effective in all cases. Likewise, patients who require a re-operation of the posterior fossa or spinal cord re-exposure surgery that precludes a time consuming dural opening should also be excellent candidates for direct application of ultrasonic aspiration.

Because ultrasonic aspiration could be damaging to the normal brain, proper use requires that its contact with normal tissue be prevented. Placement of cotton patties, or other barrier over the surrounding tissue to protect it against inadvertent suction or vibration damage to the cortex, should diminish this risk.

CONCLUSIONS

Direct application of ultrasonic aspiration in

dural reopening is easily accomplished, and it is widely available. Incremental aspiration by means of CUSA can safely provide immediate and nearly complete dural detachment.

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RESUMEN

La separación de la duramadre del cerebro subyacente en las reoperaciones, habitualmente se hace mediante coagulación bipolar, corte de vasos y adherencias y disección roma. El conocimiento de la forma de trabajar de la aspiración ultrasónica (Caviton Ultrasonic Surgical aspirator CUSA) llevó a los autores a utilizarlo en la interface cerebro-duramadre, para reducir el sangrado y la agresión al tejido cerebral, posibilitando la apertura dural en las reoperaciones.

Se examina el efecto de esta técnica en las reoperaciones de 10 pacientes operados previamente por padecer epilepsia (5 temporales y 5 extratemporales). Rápidamente se logró despegar la duramadre del cerebro, permitiendo visualizar la superficie cerebral sin distorsiones. La técnica consiste en la aplicación del aspirador ultrasónico en el ángulo diedro formado por la duramadre y el cerebro, lo que produce una inmediata desvascularización de la duramadre, reduciendo el sangrado no sólo dural sino también del cerebro.

Palabras clave: *aspirador ultrasónico, desprendimiento de duramadre, reoperación.*