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Guest Editorial

Application of cavitron ultrasonic surgical aspirator (CUSA) in orbital surgeries

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The bony orbit is a confined space housing apart the eye globe, several other vital structures. A variety of pathologies, both benign and malignant affect the orbit and operating within a small surgical field can prove to be tricky and challenging. The surgical goal in orbital lesions remains appropriately dealing with the pathology while conserving and protecting the surrounding structures. Technological and surgical advancements through decades have made orbital surgeries much easier and safer, with drills and ultrasonic instruments replacing the good old hammer and chisel. One such advancement is the Cavitron Ultrasonic Surgical Aspirator (CUSA), an innovative device that fragments and aspirates tissues, while irrigating and aspirating the surgical area at the same time. This device employs low frequency ultrasonic waves to fragment the target tissue while minimizing collateral damage to surrounding structures.

CUSA has been a part of the surgical armamentarium of various disciplines[1] including neurosurgery, hepatobiliary surgery, gastrosurgery and in the recent years, has found its way in ophthalmology too. The machine is run by a console, connected to a handpiece and controlled with a foot pedal system. As alternating current passes from the console to the handpiece, a magnetic field is generated in the handpiece, through a coil. Oscillatory vibrations are produced, as a result, which travel along the metal body to the tip of the handpiece. The vibrating tip, on gaining contact with the tissue, leads to tissue fragmentation. A variety of interchangeable tips are available, that can be attached to a universal handpiece, depending on the type of tissue to be fragmented. The tip stroke determines the speed of tissue fragmentation, and can be modulated by increasing or decreasing the amplitude, as per the surgeon's choice. Tissues such as blood vessels, nerves, ligaments/tendons possess robust intercellular bonds and provide resistance to damage by the fragmentation process. The CUSA system possesses an efficient aspiration-suction mechanism. A silicon sheath around the handpiece delivers irrigating fluid to lubricate tissues as well as reduce heat generation while the strong suction system removes debris and keeps the surgical field clear. All the different parameters can be modified through the console and handpiece system can be controlled with the foot switch. Amongst the various CUSA machines available, Sonopet® [Stryker®, Kalamazoo, MI (USA)][2] is a commonly used machine and the same has been employed by the authors in their cases (Figure 1).

CUSA-aided surgeries have been performed by neurosurgeons since many years for intracranial and spinal surgeries[3–6] and now, more recently, ophthalmological uses are also coming to light. Oculoplastic surgeons have utilized CUSA for bony orbital decompression,[7,8] in dacryorhinostomy (DCR) surgery[9] and for management of orbital tumors.[10,11] At lower frequencies, the torsional vibratory movements of the handle tip create an ideal

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Fig. 1: Handpiece of the Sonopet® [Stryker®, Kalamazoo, MI (USA)] is shown in the surgical field

milieu for cutting through bone, while causing minimal soft tissue trauma. CUSA system holds certain distinct advantages over the conventional methods for bone removal such as hammer-chisel and bone drills. CUSA allows for accurate bone sculpting, causes minimum soft tissue trauma and needs lesser force generation for bone removal.[10] Murchison et al.[9] utilized CUSA system for bony osteotomy creation in endoscopic DCR and reported efficacy and success rates similar to bone drills. The safety and efficacy of CUSA system for removal of the lateral wall of orbit for the purpose of orbital decompression in thyroid orbitopathy has been documented by Cho[7] and Bengoa-González.[8] Higher frequency settings of the CUSA system are ideal for soft tissue fragmentation. Use of CUSA for orbital biopsy, for removal of recurrent complex tumors and soft tissue masses has also been described in literature.[10,11]

Fig. 2: (**a**): showing severe exophthalmos in a 45-year-old male with thyroid orbitopathy, (**b**): same patient as in figure (a) after deep lateral wall orbital decompression with CUSA system at 3 months post-operative visit; (**c**): sight-threatening thyroid eye disease in a 32-year-old patient with uncontrolled hyperthyroidism, (**d**): 3-months post-operative photograph of the patient from figure (**c**): after deep lateral wall orbital decompression with CUSA

In the authors' own experience, CUSA has been applied for deep lateral wall bone decompression in thyroid orbitopathy cases (Figure 2), for lateral orbitotomies as well as for removal of orbital and optic nerve tumors. For soft tissue fragmentation and tumors, the soft tissue straight tip of Sonopet® device is used while for bone sculpting and disintegration, the Serrated knife and Spetzler claw tips are used. Precise bone cutting with minimal dislodgment of fragments with CUSA have helped in desirable bone contouring even in complicated cases. The authors have also employed CUSA system for debulking optic nerve tumors with good long-term results. The handpiece of CUSA machine can be manipulated according to need in the smaller confines of the orbit. The integrated cooling mechanism ensures that adjacent structures do not suffer thermal damage. Handling of the CUSA handpiece should be appropriate in order to avoid blocking the irrigation mechanism and causing inadvertent heat-induced injury to the surgeon or the patient. The ability of CUSA to spare blood vessels and nerves only adds to its reputation as a valuable tool in orbital surgery. However, as the experience with CUSA in orbital surgeries remains limited, dissection around vessels should be careful and large amounts of tissue should not be resected too rapidly. With a lot of potential yet to be discovered, CUSA may prove to be a promising addition in the toolkit of oculoplastic surgeons.

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