

Harmonic Devices: The Workhorse for Surgical Resection of Vascular Malformations

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Abstract

Management of vascular malformations is multimodal with documented role of surgical resection in specific facets of this condition. Surgical resection of these lesions is technically challenging owing to diffuse and relatively ill-defined extent with involvement of multiple tissue planes limitation of access and excessive intra-operative bleeding. An observational study was conducted in 24 cases taken up for surgical resection of vascular malformations. The cases were divided into two groups based on the hemostasis technique used: Group A: Harmonic shears ($n = 12$) (Ethicon Inc. Somerville, New Jersey, United States). Group B: Electrosurgery (monopolar/bipolar) with standard knot tying ($n = 12$). We conclude that use of harmonic scalpel in surgical resection causes less parallel tissue damage, secures haemostasis promptly, does not impede vision and aids surgical dissection thereby significantly reducing the operative time and improving the surgical outcome, typically in large vascular malformations of head and neck region.

Keywords: arteriovenous, harmonic, hemostasis, malformation, vascular

INTRODUCTION

Vascular malformations are categorized as fast-and slow-flowing types based on the presence or predominance of arterial elements.^[1] Management is multimodal with documented role of surgical resection, sclerotherapy, embolization, and pulsed-dye laser. Surgical resection of these lesions is technically challenging owing to limitation of access and excessive intraoperative bleeding [Figures 1–4]. Techniques such as extensive use of electrosurgical devices and knot tying are standard practices, but with shortcomings. Through this study, we suggest the use of harmonic shears in resecting these vascular growths for improving the surgical outcome.

MATERIALS AND METHODS

An observational study was conducted in 24 cases taken up for surgical resection of vascular malformations. The cases were divided into two groups based on the hemostasis technique used:

Group A: Harmonic shears ($n = 12$) (Ethicon Inc. Somerville, New Jersey, United States)

Group B: Electrosurgery (monopolar/bipolar) with standard knot tying ($n = 12$)

Patients with syndromic presentations, preexisting coagulopathy, or medical comorbidities with prior history of intervention were excluded.

The variables included were size and site of the lesion, volume of lesion excised, and nature of malformation (fast/slow flow).

Observations were made in terms of size and extent of the lesion excised or debulked, total operating time, perioperative hemostasis in terms of ooze from suture line, soakage of dressing, need for reexploration, ease of surgical dissection, inadvertent injury to adjacent structures, and postoperative outcomes such as pain, healing, and recurrence rate.

RESULTS

The difference in blood loss noted was insignificant in smaller volumes of resection (<200 mL) ($P = 0.157$),

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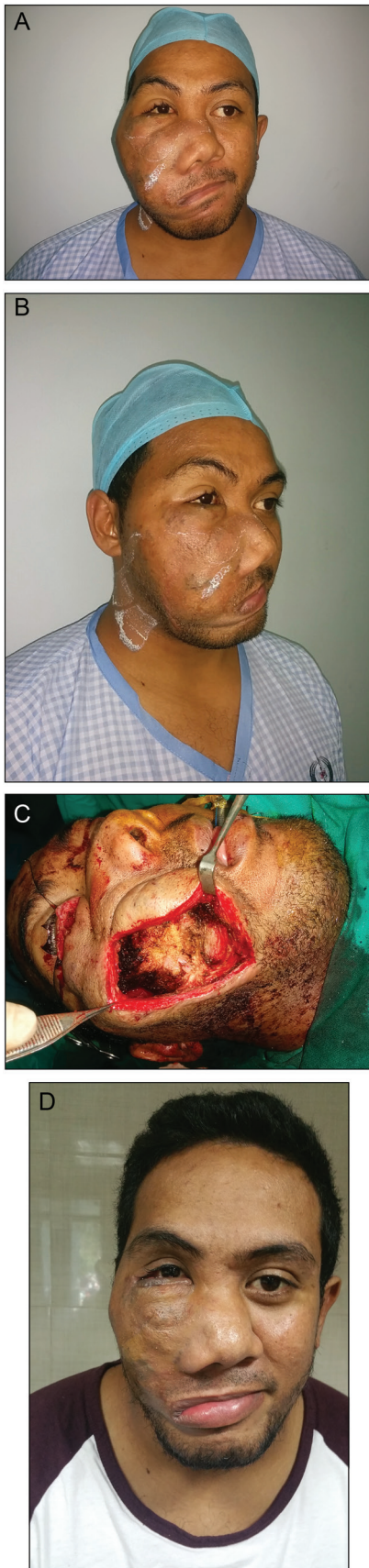


Figure 1: (A) Vascular malformation face (right cheek). Recurrent growth with previous surgical scar on the cheek. (B) Same patient (lateral oblique view). (C) Postresection. (D) Postoperative (3-month follow-up)

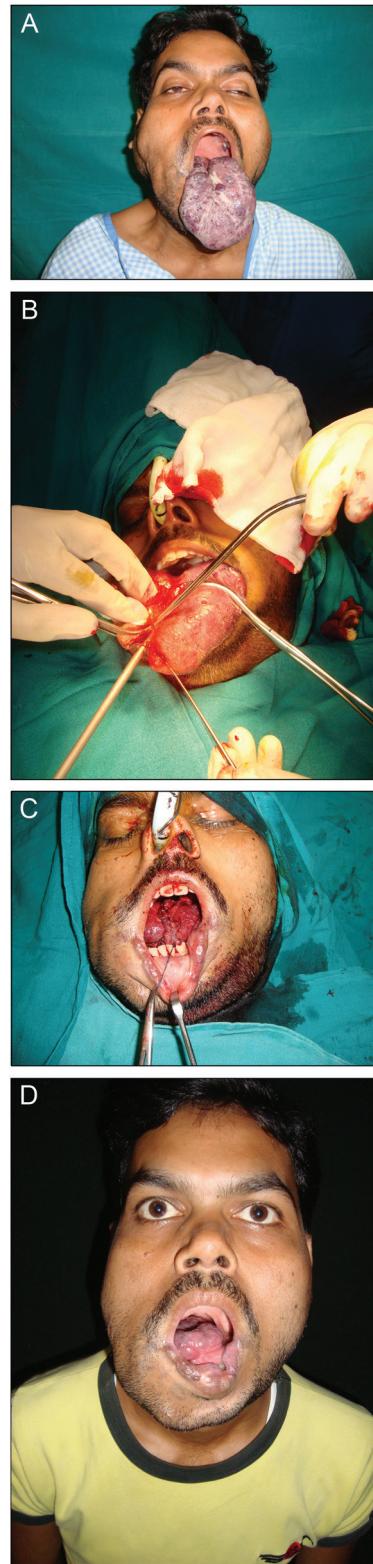


Figure 2: (A) Vascular malformation tongue. (B) Use of harmonic scalpel. (C) Postresection. (D) Follow-up at 3 months

especially in slow-flow malformations in extremities. In large-volume resections (≥ 200 cc), a notable difference was observed in blood loss and operating time in the two groups ($P < 0.000187$). The operating time for resection of volumes

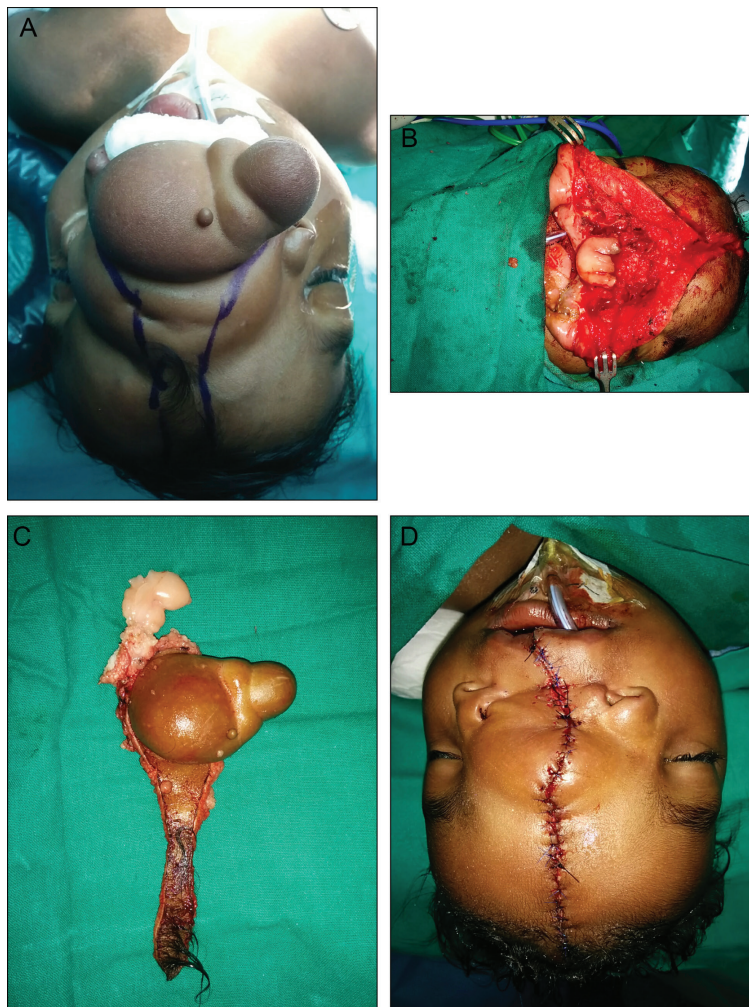


Figure 3: (A) Vascular growth with frontonasal deformity. (B) Intra-op after resection. (C) Resected mass. (D) Postoperation

>200 cc in the head and neck region was approximately 170–200 min (mean = 160 min) with electrosurgery and/or knot tying and was 90–120 min (mean = 110 min) with harmonic shears. Lesser strokes were required, and none of the cases had postoperative ooze and dressing soakage. In fact in only one case that involved resection >300 cc, postoperative hemoglobin fall by 0.5 g% was observed.

Postoperative transfusion was required in a couple of cases when electrosurgery was carried out. In the cases where harmonic shears ($n = 12$) were used, the patients were largely asymptomatic in postoperative period. Long-term follow-up was also satisfactory, though a few opted for post-resection contour deformity correction.

DISCUSSION

Vascular malformations are due to unregulated proliferation of vascular elements during embryogenesis.^[2] Limited access diffuses asymmetric layout in multiple tissue planes, and excessive bleeding hampers vision and adds significantly to operative time and blood loss.

With standard knot tying, it is difficult to get a solid tissue purchase against which to secure the knot. The

bleeding at the suture site causes soakage and need for reexploration. The knots tend to cut through and wide and deep bites tend to distort the surgical planes. Clips and staples tend to dislodge adding to costs and wastage.

Harmonic shear divides tissue by using high-frequency (55,000 Hz) ultrasonic energy. The active blade of the instrument vibrates longitudinally against an inactive blade over an excursion of 50–100 μm .^[3] This mechanical action disrupts protein–hydrogen bonds. Coaptive hemostasis occurs at a lower temperature (80°C) causing a minor tissue injury (<1.5 mm) compared with electrocautery.^[4,5] The proteoglycans and collagen fibers are denatured and form a coagulum.^[6]

A minimal tissue charring and desiccation, and better visualization are seen, and the zone of thermal injury is greatly reduced.^[7] The potential hazard to the patient from electrosurgical smoke is avoided.^[8] The depth of penetration is more gradual. Larger blood vessels can be sealed as opposed to monopolar devices.^[9] The lateral spread of energy is considerably less with superior repair and lesser postoperative adhesions.^[10]



Figure 4: (A) Vascular malformation (left cheek). (B) Lateral view. (C) Postoperative follow-up at 10-months. (D) Lateral view (10-month postoperative)

CONCLUSION

Harmonic devices have definitive benefits in surgical resection of vascular malformations. They ease the surgical procedure achieving efficient, prompt, and secured hemostasis in one stroke. They significantly reduce the operative time, the amount of intraoperative and postoperative blood losses, and the length of hospital stay. Caution is required in flammable atmosphere and with pacemakers. Good instrument care is mandatory to ensure safety and reliability.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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