

# **Effect of intraoperative intravenous lignocaine infusion on the haemodynamic stability and postoperative recovery following intracranial aneurysm surgery: A case series**

## **INTRODUCTION**

Subarachnoid haemorrhage (SAH) presents as a neurosurgical emergency with symptoms ranging from headache to overt neurological deficit and cardiovascular instability. Intracranial aneurysmal rupture accounts for 85% SAH cases with a subsequent significant morbidity (>50%) and mortality (>25%).<sup>[1,2]</sup> Surgery constitutes the definitive treatment. Herein, an optimal anaesthetic management revolves around the pivotal aim of maintenance of the perioperative haemodynamic stability and the adequacy of cerebral perfusion.<sup>[3]</sup> In this context, an intravenous lignocaine infusion is promising as it blunts the surgical stress response with an analgesic contribution.<sup>[4,5]</sup> Nevertheless, the dearth of evidence on its role in perioperative SAH setting prompted this index case-series aimed at evaluating the effect of lignocaine infusion on the haemodynamic perturbations and recovery in 10 patients following aneurysm clipping surgery.

## **CASE-SERIES**

We enrolled 10 American Society of Anaesthesiologists (ASA) physical status II patients of either sex between 30 and 50 years of age scheduled for an elective intracranial aneurysm surgery. A written informed consent was obtained. All the participants classified as World Federation of Neurological Surgeons scale (WFNS) grade I, controlled hypertensives on treatment including nimodipine for at least a week before the intervention. The patients with an anticipated difficult airway, weight <50 kg, local anaesthetic (LA) hypersensitivity, or comorbidities which could significantly alter the drug pharmacokinetics (acidosis, hypoproteinaemia, severe hepatic and renal impairment, congestive cardiac failure, etc.), long-term opioid therapy or remarkable intraoperative complications such as major

bleeding and those refusing enrolment were excluded. Preoperatively, patients were thoroughly examined, baseline investigations obtained, and numerical rating scale (NRS) explained for postoperative pain assessment.

The patients were kept nil per oral as per ASA guidelines and advised to take morning antihypertensive dose 2 hours prior to surgery. After wheeling into the operation theatre, standard ASA monitors were applied. However, depth of anaesthesia could not be monitored owing to the technical difficulty and surgical concerns during electrode placement. A wide bore intravenous cannula was secured, and alternate ringer lactate/normal saline initiated. Clinical parameters namely heart rate, blood pressure, oxygen saturation were recorded at the following time points: Baseline (T0), pre-induction (T1), post-intubation (T2), pre-positioning (T3), post-positioning (T4), pre-extubation (T5) and post-extubation (T6). All patients received preservative-free lignocaine (2%) 1.5 mg/kg bolus IV over 10 minutes as premedication followed by 1.5 mg/kg/hr IV till tracheal extubation. After lignocaine bolus, 0.02 mg/kg midazolam and 1 µg/kg fentanyl were administered, intravenously. A 20G arterial cannula was secured in the non-dominant radial artery. Anaesthesia was induced with Inj. Propofol (1-2 mg/kg IV), titrated to achieve loss of verbal response. Following check ventilation, neuromuscular block was achieved with injection vecuronium (0.1 mg/kg loading and 0.02 mg/kg IV maintenance dose) using neuromuscular monitoring. At the time of pinning, injection fentanyl 0.5 µg/kg IV was administered along with LA infiltration and additional fentanyl (0.5 µg/kg IV) was supplemented during dural opening. Anaesthesia was maintained with sevoflurane (minimum alveolar concentration (MAC) ≤1), oxygen/air (FiO<sub>2</sub> - 0.4) with end tidal carbon dioxide between 30 and 35 mm Hg. Following surgical clipping, Inj. paracetamol (15 mg/kg) and Inj. Ondansetron (0.1 mg/kg) were given intravenously and inhalational anaesthetic was down titrated from the commencement of skin closure. After completion of surgery, neuromuscular blockade was reversed with Inj. neostigmine 50 µg/kg and Inj. glycopyrrolate 10 µg/kg IV based on the train of four count. Trachea was extubated when the patient responded to verbal command with the time to extubation estimated from the point of reversal agent administration. Postoperative pain was assessed every fifteen minutes till one-hour post-extubation (NRS; 0 to 10, 0 = no pain, 10 = worst imaginable pain) wherein

NRS  $\geq 4$  was classified as an indication for rescue fentanyl analgesic dose (0.5  $\mu\text{g}/\text{kg}$  IV). Ramsay sedation scale was also evaluated at these points. The consensus guidelines on the haemodynamic management during intracranial aneurysm surgery advocate that the systolic blood pressure should be maintained  $<160$  mm Hg before clipping, with no more than 20% fluctuations in the perioperative haemodynamic parameters from the baseline.<sup>[2,3]</sup> Post-clipping, the mean arterial pressure (MAP) should be maintained between 70 and 90 mm Hg.<sup>[6]</sup> In our patients, at all times, haemodynamic parameters were within 20% of baseline values [Table 1]. All patients had permissible postoperative sedation (1–3) and pain score ( $\leq 3$ ) with an allowable time to extubation [Table 2]. None of the patients required rescue fentanyl analgesic dose or any other treatment for postoperative nausea and vomiting (PONV) [Table 2].

**DISCUSSION**

The anaesthetic management of aneurysm surgery focuses around ensuring stable perioperative haemodynamics and maintaining optimal intracranial pressure (ICP) to provide favourable surgical conditions and avoid complications.<sup>[3]</sup> Majority of

these patients are hypertensives (controlled or labile) wherein substantial fluctuation in transmural pressure gradient may precipitate intraoperative rupture with consequential elevated mortality (75%). During anaesthetic induction, various drugs like opioids, beta blockers, additional propofol dose and intravenous lignocaine are employed to blunt laryngoscopy response.<sup>[7]</sup> In addition, a range of intraoperative events such as patient positioning, pinning, surgical incision, periosteal stripping and dural opening, may potentially precipitate a hypertensive episode necessitating meticulous anticipation and pre-emptive treatment.<sup>[7]</sup> Nevertheless, the delayed recovery and interference with postoperative neurological assessment offset the beneficial haemodynamic impact of the supplemental intraoperative opioid administration.

With the advent of opioid-free anaesthesia, alternative drugs and anaesthesia techniques presenting a viable potential of minimising the perioperative opioid consumption and ensuring an augmented recovery are captivating attention.<sup>[8,9]</sup> The reduction in the perioperative opioid requirement with the concomitant administration of intravenous lignocaine in the present study bears testimony to the aforementioned. Intravenous lignocaine has proved

**Table 1: Demographic profile and systolic blood pressure at different time points**

Age (yrs)	Sex	Surgical Duration (min)	Haemodynamic parameters [SBP/DBP (MAP)]							
			T0	T1	T2	T3	T4	T5	T6	
35	M	140	136/86 (72)	120/72 (68)	146/84 (76)	126/76 (76)	136/76 (78)	130/78 (74)	148/78 (82)	
37	F	150	140/84 (76)	120/68 (70)	154/84 (80)	130/74 (76)	144/84 (78)	120/74 (70)	154/86 (85)	
50	F	130	138/74 (72)	124/80 (76)	146/78 (78)	126/76 (78)	148/84 (80)	136/84 (76)	150/86 (84)	
45	F	140	128/70 (68)	112/68 (66)	136/78 (72)	116/74 (72)	138/78 (78)	124/76 (73)	140/80 (80)	
40	M	145	120/72 (68)	112/70 (66)	132/82 (74)	116/68 (72)	130/78 (76)	128/72 (73)	142/84 (78)	
42	F	140	126/70 (66)	120/72 (68)	138/78 (70)	116/68 (68)	138/80 (72)	120/70 (73)	140/84 (76)	
36	M	150	128/74 (68)	118/70 (66)	134/82 (74)	120/74 (70)	140/80 (74)	126/78 (73)	140/84 (78)	
32	M	140	112/68 (66)	108/70 (66)	134/78 (76)	114/66 (70)	124/68 (70)	116/74 (71)	136/76 (74)	
30	M	130	118/74 (66)	110/72 (68)	134/82 (76)	110/70 (70)	130/78 (74)	128/70 (72)	146/74 (76)	
48	F	140	110/70 (68)	118/74 (70)	130/76 (80)	116/70 (70)	124/76 (72)	122/68 (72)	132/72 (72)	

SBP – Systolic blood pressure; DBP – Diastolic blood pressure; MAP – Mean arterial pressure

**Table 2: Parameters of postoperative recovery profile**

Time to extubation (Min)	Mean Ramsay sedation score	Mean Postoperative pain score (NRS)	Rescue fentanyl analgesia	PONV
6	1	3	No	No
5	1.5	2.5	No	No
4	1	2	No	No
6	2	2	No	No
5	1	1.5	No	No
6	1.5	1.5	No	No
6	2	2	No	No
7	2	1.5	No	No
5	1	1	No	No
6	2	2	No	No

efficacious in blunting stress response across diverse surgical specialities.<sup>[4,5]</sup> At the same time, it attenuates intracranial hypertension (ICH) by obtunding the haemodynamic surges and decreasing the effective cerebral blood flow. Moreover, the sodium channel inhibition diminishes the cerebral metabolic demands and excitotoxicity, ameliorating ICH furthermore.<sup>[10]</sup> The combination of these two mechanisms favourably modulates the cerebral blood flow-metabolism coupling central to neuro-protection. Additional advantages include a 48% decline in MAC, reduction of the postoperative pain and opioid consumption, decreased incidence of postoperative ileus, proposed decline in the incidence of postoperative thrombotic and cognitive complications and attenuating the airway hyper-reactivity pertinent to the aim of a smooth extubation in this high-risk surgical subset.<sup>[5,11]</sup> Albeit the concern of LA systemic toxicity, literature highlights that the plasma concentrations remain well below the toxic level (5 µg/ml) even after 24 hours of lignocaine infusion in doses ranging from 1 to 2 mg/kg/hr (in background of meticulous exclusion of coexisting pathologies).<sup>[5,11]</sup>

To the best of our knowledge, the present case-series is novel in the context of the application of intravenous lignocaine infusion for the perioperative management of aneurysm surgical patients centralising the focus on clinically pertinent outcomes like haemodynamic stability and postoperative recovery. The index series focuses on minimising significant haemodynamic perturbations owing to the major perioperative stressors aimed at the maintenance of physiological MAP. While a school of thought can potentially argue in favour of maintaining higher MAP post-clipping, we do not routinely practice post-clipping deliberate hypertension in our centre particularly in surgical settings at lower risk of vasospasm. Moreover, Akkermans *et al.* demonstrate the importance of a standardised intraoperative blood pressure management with regards to the postoperative neurological outcome in their recent retrospective observational study.<sup>[12]</sup>

## CONCLUSION

The set of observations suggest that intravenous lignocaine can prove to be a valuable adjunct to the anaesthetic management of cerebral aneurysm surgery by ensuring stable haemodynamic milieu, augmenting perioperative opioid-sparing and postoperative recovery. Nevertheless, further studies with larger

sample size are required to validate the preliminary encouraging findings.

## 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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