DOI: 10.21088/ijaa.2349.8471.12125.7

Indian Journal of Anesthesia and Analgesia
Volume 12 Number 1 January - March 2025

Case Report

Neuroanesthetic Concerns during Removal of Giant Intracranial Hydatid Cyst: A Case Report

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How to cite this article:

Kunal Kumar Sharma, Shyam Chandran, Vartika Chauhan et. al, Neuroanesthetic Concerns during Removal of Giant Intracranial Hydatid Cyst: A Case Report. Ind J Anesth Analg. 2025; 12(1): 39-43.

ABSTRACT

Introduction: Intracranial hydatid cysts are rare supra-tentorial lesions in the neurosurgical population of India.

Methodology: In this report, we presented a case of a 18 year old male patient with midline shift, posted for excision of hydatid cyst in brain. The use of dexmeditomidine alongwith sevoflurane for anesthetic induction helped in achieving optimal intra-operative brain relaxation and a good surgical outcome for this patient.

Results: Neuroanesthetic monitoring for this patient encompassed the state entropy monitoring, cerebral blood flow velocity monitoring, non-invasive intra-cranial pressure monitoring and analgesia monitoring in conjunction to the standard ASA monitoring.

Conclusion: The authors advocate similar management for achieving optimal standard of care while operating giant cystic lesions in supra-tentorial compartment.

KEYWORDS

• Neuroanesthesia • Hydatid cyst • Neurosurgery • TCCD • Dexmeditomidine

KEY MESSAGE

Emphasis on need of Neuro-monitoring during surgery for supra-tentorial lesions in brain.

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➢ **Received:** 20-11-2024 ➢ **Revised:** 22-11-2024 ➢ **Accepted:** 28-12-2024

INTRODUCTION

Intracranial Hydatidosis is a rare presentation by the larval stage of Echinococcus granulosus complex. Its incidence is mere 2-3% of supratentorial lesions. Although lung and liver are common sites of presentation, the intracranial presentation is extremely rare and bears a myraid of symptoms and signs.[1] Nevertheless, whenever detected in brain, these cysts are typically present as intra-axial lesions with thin-walls. They do not invade brain parenchyma, therefore they are devoid of perilesional oedema.[2] Temporo-pariet al. areas of cerebral hemisphere is the most common site of location of these lesions.[3] The increased dimensions of the cyst due to late clinical presentation lead to mass effect and midline shift.

These lesions follow the Monro–Kellie doctrine when they are located in the supratentorial compartment. As a consequence of which, there exists only a limited compensation within the intracranial mileu for the enlarging hydatid cyst. This necessitates the monitoring of intracranial pressure (ICP). Non-invasive methods like transcranial colour coded duplex sonography (TCCD) and optic nerve sheath diameter (ONSD) have been reported as effective neuromonitoring tools during surgery.[4,5]

The benchmark treatment is intact removal of the cyst without spillage of intra-cystic contents to prevent recurrence and possible anaphylactic reaction. The rupture of hydatid cyst during surgery leads to devastating neuro-inflammation and brain edema.[6] Therefore in order to establish an extended safety measure we decided to modify our anesthetic induction, by using dexmeditomidine as an induction agent and continuing its use during anesthetic maintenance. The reason for using dexmeditomidine was justified by the recent emerging evidence of neuronal preservation, anti-inflammation and reduction in lipid peroxidation.[7] The anti-inflammatory effect of dexmeditomidine was found to be comparable to methylprednisolone in the work by Can *et al*.[8] Dexmeditomidine also reduces tissue oedema, inflammation and apoptosis.[9]

METHODOLOGY

The present case report meets the directives of the CARE (Case Report) guidelines. The present case was a 18 year old male, having complaints of weakness of left upper limb for 2 months. On examination, power was 3/5 on the Medical Research Council (MRC) score on ipsilateral side of the lesion. The cranial nerve examination did not reveal any anisocoria or esotropia. Preoperative Montreal Cognitive Assessment (MoCA) score was 25.

Magnetic Resonance Imaging (MRI) revealed presence of giant 7 cm x 7.1 cm x 6.5 cm cyst in right fronto-pariet al. region with with subfalcine herniation (*Fig. 1*) that corresponded to phase III of the cerebral autoregulatory curve. However, in the absence of perilesional edema, it was concluded that the blood–brain barrier (BBB) was preserved.

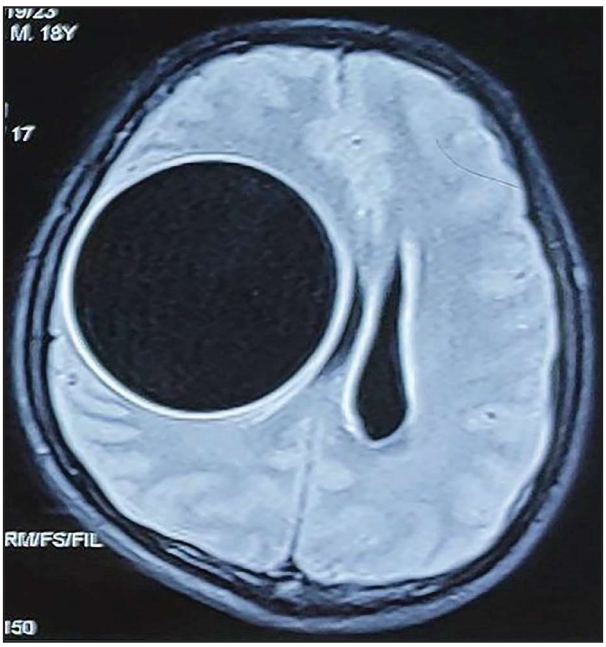


Fig. 1: T1 weighted axial view of MRI brain

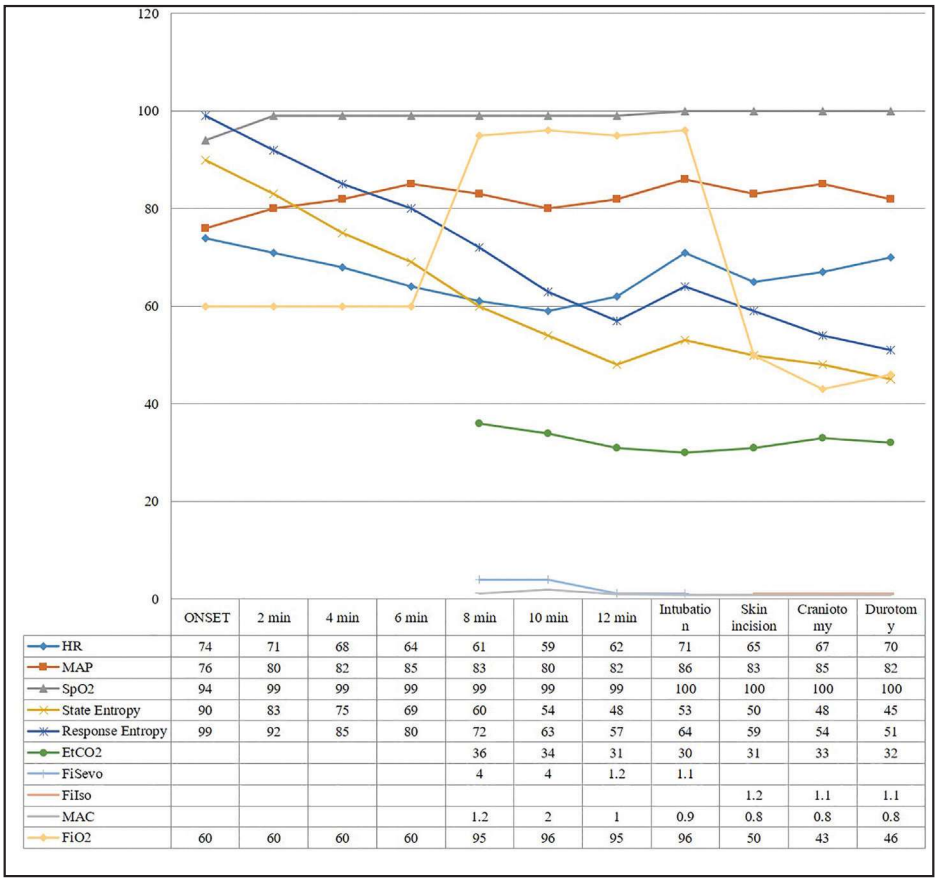
Nevertheless, there existed a possibility of variation between the regional cerebral blood flow and cerebral oxygenation on both the sides of the lesion. Therefore we conducted pre-induction, post-intubation and post-operative TCCD through trans-temporal window to assess the non-invasive ICP using the TCCD derived pulsitality index.

There was no need to administer sedative premedication to this patient as he was cooperative. His preoperative hydration status was optimal as per our clinical assessment. Prior to initiation of anesthesia protocol, we applied the GE Entropy sensor in a modified position on left maxilla in order to evaluate the anesthetic depth throughout the surgery.

Maintenance of cerebral perfusion pressure (CPP) and prevention of tight brain comprised the prime goals of our anesthetic management. As a secondary goal to provide neuro-protective anesthesia and facilitation of early emergence, we decided to perform anesthetic induction using an integrated dexmeditomidine-sevoflurane based algorithm.[10]

As per this algorithm, dexmeditomidine infusion was started @0.6 mcg/kg/min for ten minutes. Fentanyl 2 mcg/kg iv was administered at the stated time interval and the anesthetic plane was deepened further by sevoflurane 4%. The anesthetic depth was continuously monitored using the indices of state entropy (SE) obtained through the GE Entropy sensor placed on the maxilla. Loss of consciousness was attained at 10 minutes, and to facilitate endotracheal intubation, we administered 0.15 mg/kg vecuronium intravenously. The quality of intubation scored as per the modified Viby-Mogensen criteria,[11] was[14].

Bilateral scalp block was given under sonographic guidance using an injectate mixture of 0.375% bupivacaine with 1:200000 epinephrine. As we had applied the entropy sensor in the modified position, it did not interfere with the application of scalp block. The hemodynamic and ventilatory parameters alongwith entropy values were monitored (*Fig. 2*). Anaesthetic maintenance was carried out on Air-Oxygen-Isoflurane mixture alongwith dexmeditomidine @ 0.5 mcg/kg/hr. In addition to the Standard American Society of Anesthesiologists' monitoring equipments, we additionally monitored the minimum alveolar concentration (MAC), state entropy and surgical plethysmographic index (SPI) intraoperatively.



	ONSET	2 min	4 min	6 min	8 min	10 min	12 min	Intubation	Skin incision	Craniotomy	Durotomy
HR	74	71	68	64	61	59	62	71	65	67	70
MAP	76	80	82	85	83	80	82	86	83	85	82
SpO2	94	99	99	99	99	99	99	100	100	100	100
State Entropy	90	83	75	69	60	54	48	53	50	48	45
Response Entropy	99	92	85	80	72	63	57	64	59	54	51
EtCO2					36	34	31	30	31	33	32
FiSevo					4	4	1.2	1.1			
FiIso									1.2	1.1	1.1
MAC					1.2	2	1	0.9	0.8	0.8	0.8
FiO2	60	60	60	60	95	96	95	96	50	43	46

Fig. 2: Trend of hemodynamic and ventilatory parameters

Abbreviations used:

HR - heart rate (beats/minute); **MAP** - mean arterial pressure (mmHg); **SpO_2** - peripheral oxygen saturation (%); **$EtCO_2$** - end tidal carbon di-oxide concentration (mmHg); **FiSevo** - fraction of inspired sevoflurane (%); **FiIso** - fraction of inspired isoflurane (%); **MAC** - minimum alveolar concenteration (%); **FiO_2** - fraction of inspired oxygen (%).

Usage of dexmeditomidine during the anesthetic maintenance mitigated the possible foci of intraoperative hypertension (i.e. Mayfield pin insertion, periosteum elevation etc.). This was crucial part of our anesthetic technique as intraoperative hypertension will increase the cerebral blood volume (CBV) beyond the autoregulation capacity and consequently elevate the ICP.

We used 0.9% normal saline alternating with a balanced salt solution as maintenance fluid in the present case. This had the advantage of avoiding the risk of hyperchloremic metabolic acidosis which could arise if solely 0.9% normal saline had been used. Euglycemia was ensured by keeping the intraoperative blood glucose levels within the range of 120–160 mg/dl. This helped in avoidance of acidosis and anaerobic metabolism.

Additionally, 100 ml of 20% Mannnitol and 4 mg of dexamethasone were given intravenously. Mannitol played its part in reducing the ICP, while dexamethasone has shown promising role in reduction of perilesional edema by decreasing the leakage from neocapillaries formed around the hydatid cyst.

The neurosurgery team conducted a right pariet al. craniotomy followed by cortisectomy of 3/4th of larger diameter of the cyst. Thereafter they irrigated the area between the cyst wall and brain with warm hypertonic saline. Using Dowling technique, the intact cyst was removed without spillage (*Fig. 3*). Dexmeditomidine infusion was turned off after closure of dura. The skin was sutured in layers.

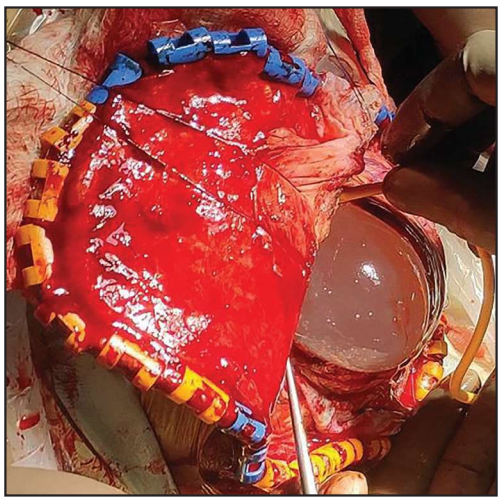


Fig. 3: Hydatid cyst exposed after cortisectomy for removal by Dowling's technique

A loading dose of leviteracetam was given intravenously to mitigate peri-operative seizures. Due to this very concern, it was decided by the team to shift the patient to intensive care unit and electively ventilate him. Postoperative TCCD was done on the non-operated side of the patient, it revealed the mean middle cerebral artery (MCA) flow velocity of 68 cm/seconds. The patient was managed on anti-epileptics and ventilatory support for 48 hours until extubation. He had an uneventful post-operative course in the institute thereafter until his discharge.

DISCUSSION

The evidence of neuro-protective effects of dexmeditomidine has been reflected in the work by Gau and colleagues.[9] The study cohort of anaesthetised rats with right spinal cord contusion at C5 level demonstrated decreased inflammation and induration alongwith significant improvement in ipsilateral upper-limb motor dysfunction ($p < 0.0001$) in the interventional group. They also observed significant sparing of white matter ($p < 0.05$), and reduction of activated macrophages ($p < 0.05$) at the site of injury in the interventional group.

The case series by Ramsay *et al*.[13] used dexmeditomidine as total intravenous anaesthesia in three patients who did not had any neurosurgical pathology. Whereas the case series published by Sharma *et al*.[10,15] included patients undergoing spine surgeries underwent anesthetic induction using the integrated dexmeditomidine-sevoflurane algorithm. The latter did not observe any untoward adverse events during their anesthetic induction in the patients.

The work by Mu and colleagues determined the ED_{50} and ED_{95} infusion rates of dexmeditomidine as 0.115 and 0.200 µg/kg/min. The mean induction time was however 18.3 minutes in their study cohort.[14]

CONCLUSION

The present case demonstrates that our integrated algorithm achieved optimal quality of intubation in this patient. However, a larger study cohort is required to advocate the use of dexmeditomidine as sole induction agent in neurosurgical patients.

Limitations: This is a case report of a single patient. Level 1 evidence shall require a randomized controlled clinical trial with a suitable power in the sample size.

Funding: The authors report no involvement in the research by the sponsor that could have influenced the outcome of this work.

Conflicts of interest: The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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