Review Article

Awake craniotomy for brain tumors during pregnancy: An updated scoping review

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Abstract

The management of brain tumors during pregnancy presents a complex clinical challenge, balancing maternal neurological needs with fetal safety. Awake craniotomy (AC) is a potential strategy to maximize tumor resection in eloquent areas while minimizing fetal anesthetic exposure, but the literature remains sparse. The objective of this review is to summarize the current evidence regarding the use of AC for brain tumors during pregnancy. Following PRISMA guidelines, a systematic search was conducted in PubMed, Scopus, Cochrane Library, and ScienceDirect databases for studies reporting on AC in pregnant patients. Data on clinical characteristics, anesthetic techniques, and maternal/fetal outcomes were extracted. Methodological quality was assessed using the Joanna Briggs Institute checklist for case reports. Eleven studies, comprising 11 patients, met the inclusion criteria. All were case reports or a small case series. AC was performed across all trimesters for various tumors, predominantly gliomas. Anesthetic techniques included both "awake throughout" and "asleep-awake-asleep" approaches, with dexmedetomidine and propofol being common agents. All cases reported successful surgical resections with positive fetal outcomes, resulting in the delivery of healthy infants. Short-term maternal neurological outcomes were generally favorable; however, long-term maternal prognosis was variable and dependent on the underlying tumor pathology. A multidisciplinary approach was highlighted as crucial for success. The available evidence, though limited to case reports, suggests that AC is a viable, effective option for carefully selected pregnant patients with brain tumors. However, the high potential for publication bias warrants caution, and larger, prospective studies are needed to establish definitive guidelines.

Keywords: Awake craniotomy, brain tumor, maternal-fetal outcomes, neurosurgery, pregnancy

Introduction

Neurosurgical pathologies, including brain tumors, are less commonly encountered during pregnancy and influence the course of pregnancy or vice versa, affecting the outcome of intracranial lesions.[1-3] Pregnancy, which is a stressful physiological condition, requires special considerations from the point of view of anesthesia as well as the definitive management of intracranial lesions.[1] The coexistence of a brain tumor and pregnancy presents unique diagnostic, anesthetic, and therapeutic challenges as both maternal and fetal safety needs to be considered.[4-6] Awake craniotomy (AC), like for other indications during pregnancy, offers a potential advantage, as it allows for maximal tumor resection while preserving eloquent brain functions through real-time neurological monitoring and minimizing fetal anesthetic exposure.[4,5,7] However, AC during pregnancy remains rarely reported, and the literature on optimal perioperative management and outcomes of these patients is not well described.[2,6,7] The most recent review, published in 2023, described a small number of cases where

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the use of AC during pregnancy was studied.[2] The current review provides an update to summarize current clinical characteristics, anesthetic techniques, and perioperative strategies; evaluates maternal and fetal outcomes; and identifies potential areas for future research.

Material and Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for the current review [Figure 1].[8] A systematic literature review was conducted using electronic databases, including PubMed, Scopus, the Cochrane Central Register of Controlled Trials (Cochrane Library), and ScienceDirect, with the search terms like key words outlined in Table 1. Studies published from database inception till September 2025 were included in the literature search. Two independent investigators screened abstracts, followed by full-text evaluations. The reference lists of included studies were also screened for additional relevant publications, and authors were contacted for missing data. Conflicts were resolved by consensus, resulting in the final list of studies.

Table 1: Details of search strategy

Database	Search details
COCHRANE	0 Cochrane Reviews matching Awake Craniotomy Pregnancy in Title Abstract Keyword
PubMed	((“awake”[All Fields] OR “awakeness”[All Fields] OR “awakes”[All Fields] OR “awaking”[All Fields]) AND (“craniotomy”[MeSH Terms] OR “craniotomy”[All Fields] OR “craniotomies”[All Fields]) AND (“pregnancy”[MeSH Terms] OR “pregnancy”[All Fields] OR “pregnancies”[All Fields] OR “pregnancy s”[All Fields])) AND (1000/1/1:2025/9/27[pdat])
ScienceDirect	Title, abstract, keywords: Awake Craniotomy Pregnancy
Scopus	TITLE-ABS-KEY (awake AND craniotomy AND pregnancy)

The population (P) was pregnant women diagnosed with intracranial tumors or other brain lesions, the intervention (I) was awake craniotomy with or without conscious sedation including intraoperative monitoring, the comparison (C) was not applicable as most studies were case reports or series, and the outcomes (O) measured were maternal neurological outcomes, intraoperative complications, anesthetic management, fetal outcomes (Apgar scores, viability, gestational age at delivery), and long-term maternal/fetal follow-up.

We included studies published in English-language case reports, case series, and observational studies reporting awake craniotomy in pregnant patients. Previous systematic reviews were screened to identify additional primary studies, and the data were extracted from the original reports to avoid duplication or bias. Studies involving nonpregnant patients, procedures performed solely under general anesthesia, nonhuman studies, editorials without clinical data, and non-English publications were excluded.

Two independent investigators assessed eligible studies and extracted data using a standardized data extraction form.

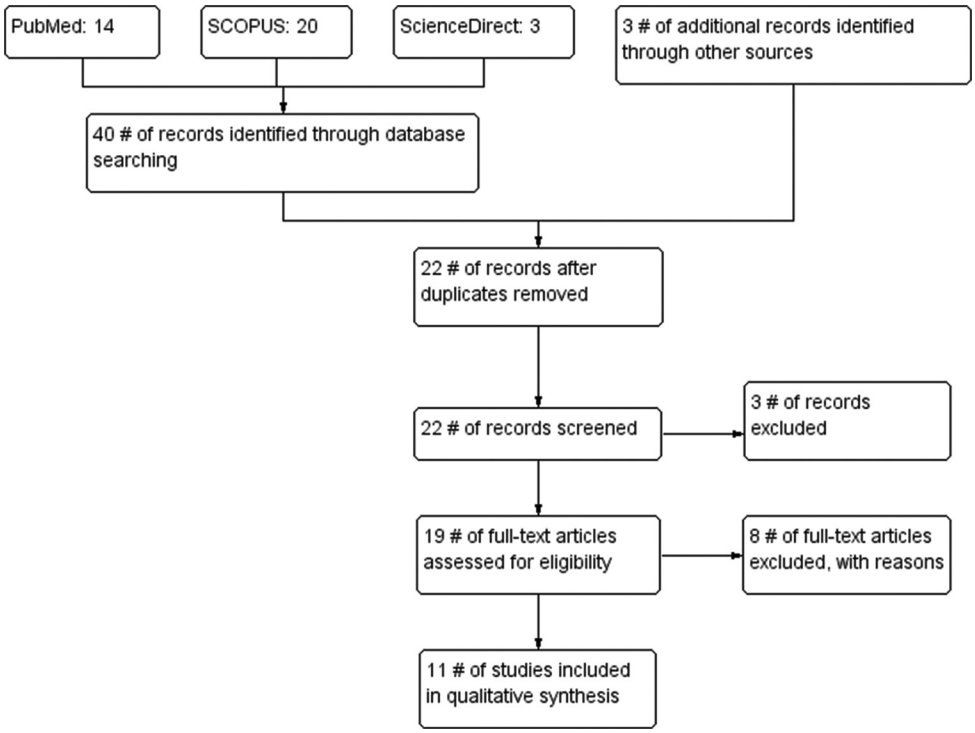

Figure 1: PRISMA flow diagram

Discrepancies were resolved by discussion or consultation with a third reviewer. The extracted data included study author, year of publication, country, study type, patient age, gestational age at surgery, tumor type/location, anesthesia techniques and medications used, intraoperative fetal monitoring details, maternal outcomes (neurological status, complications), fetal outcomes (Apgar scores, viability, gestational age at delivery, complications), and maternal and/or fetal follow-up details.

To assess the risk of bias and methodological quality of included studies, the Joanna Briggs Institute (JBI) critical appraisal checklist for case reports was used.[9]

Results

The search resulted in a total of 38 records. After removing duplicates, the titles, abstracts, and keywords of 20 records were screened, and the full text of 17 records was further evaluated. Eight articles were excluded for the following reasons [Table 2],[1,2,5,10-14] and 11 studies were included in the qualitative data synthesis [Table 1].[3,4,6,7,15-21]

All 11 included studies were case reports or small case series.[3,4,6,7,15-19] The primary objectives included the successful management of awake craniotomy in a pregnant patient,[6,15,18] perioperative decision-making and technical considerations,[4] and detailed specific anesthetic management techniques,[16,20,21] including details for the safety and feasibility of the neurosurgical procedure in rapidly growing tumors or tumors located in eloquent areas.[7,19] One case series provided details that focused on characterizing perioperative management and suggested guidelines.[3] The studies consistently identified that a multidisciplinary approach, which includes specialists from neurosurgery, anesthesiology, obstetrics/gynecology, neurology, neonatology, or psychology, is crucial to successful management and outcomes.[4,6,7,19-21]

The 11 studies included a total of 11 patients; the maternal age ranged from 24 to 40 years; surgery was performed across almost all trimesters, with the gestational age at the time of craniotomy ranging from the first trimester (10 weeks) to the third (30 weeks) [Table 3].[3,4,6,7,15-21] The most common presenting symptom was new-onset seizures (most cases generalized tonic-clonic),[6,7,15-17,19] and other common presenting symptoms were progressive focal neurological deficits (hemiparesis, numbness, aphasia), headaches, and cognitive changes.[4,6,7] The majority of tumors were gliomas of varying grades, including glioblastoma (WHO Grade IV),[7,19] anaplastic astrocytoma (WHO Grade III),[4,17] anaplastic oligoastrocytoma (WHO Grade III),[16] diffuse or low-grade astrocytomas (WHO Grade II),[3,6,21] and one case was a meningioma.[18] As expected, the lesions were typically located in supratentorial eloquent areas (e.g., frontal, temporal, or parietal lobes, adjacent to motor or language cortex)[4,7,15,16,20,21] and, in many cases, the tumor exhibited rapid growth during pregnancy, necessitating urgent intervention.[7,17]

Table 2: Characteristics of excluded studies

Study Author (Year)	Reason for exclusion
Acurio, 2023[10]	Response letter
Bocanegra-Becerra, 2023[11]	Reply letter
Bocanegra-Becerra, 2023[2]	Systematic review
Filippi, 2021[12]	Awake craniotomy postpartum not during pregnancy
Hedayat, 2017[1]	Cortical pseudoaneurysm
Mofatteh, 2023[5]	Systematic review
Nimma, 2017[13]	Conference abstract
Vascones-Roman, 2024[14]	Response letter

The most common anesthetic approach was conscious sedation or a monitored anesthesia care (MAC) "awake throughout" technique.[3,4,6,7,15,16,18,20,21] In two cases, the "asleep-awake-asleep" technique was utilized, which included general anesthesia with a supraglottic airway or endotracheal tube for the craniotomy opening and closure, with an intervening awake period for mapping.[17,19] Commonly used agents for sedation and anxiolysis include dexmedetomidine infusions,[7,15,16,19-21] propofol,[3,4,6] and short-acting opioids (remifentanil or alfentanil).[3,4,6,15,21] Scalp nerve blocks with local anesthetic agents (e.g., bupivacaine, ropivacaine, and lidocaine) were performed in all cases for surgical site analgesia.[6,7,15-21]

Pre- and postoperative ultrasound evaluation,[6,18] intraoperative fetal monitoring including continuous fetal heart rate (FHR) monitoring,[4,17,20,21] continuous toco-cardiography,[15] and intermittent Doppler ultrasound[7,19] were performed in the majority of cases, and the fetal status remained stable throughout the procedure. All patients underwent standard maternal physiological monitoring, including real-time neurological assessment (intraoperative motor and language mapping),[4,6,7,21] and, in one case, intraoperative neurophysiological monitoring (IONM), which included electrocorticography and cortical/subcortical stimulation, to achieve maximum safe resection.[19]

The majority of the patients' neurosurgical procedures could be completed without major intraoperative complications, including gross total or extensive tumor resection,[7,16,18-21] and the majority of the patients had an uneventful postoperative course with no new neurological deficits.[6,15-17,20,21] One patient had initial improvement; however, they had disease progression at follow-up.[4] One patient died 16 months after her craniotomy due to the progression of the underlying disease.[3] Adjuvant therapies

Table 3: Characteristics of included studies

Study Author, Year	Country	Study type	*n* patients (AC during pregnancy)	Maternal age (years)	Gestational age at surgery (weeks)	Tumor type/ location	Anesthesia/agents
Abd-Elsayed, 2013[3]	USA	Case report	1 (Case 4)	40	22	Glioma (Left Frontal 2.4×2.2 cm)	Awake Craniotomy: Propofol/Alfentanil for induction/maintenance
Al Mashani, 2018[15]	Oman	Case report	1	26	10	Space occupying lesion (Glioma - Right frontoparietal, 8.2×4.5×4.6 cm, motor area adjacent)	Awake Craniotomy: Low-dose Propofol, Remifentanil, Dexmedetomidine (Ramsay 2-3), Circumferential scalp block (0.25% bupivacaine + 1% lidocaine).
Gunasekaran, 2022[7]	USA	Case report	1	24	>7 (Pregnancy discovered at 7 weeks)	Glioblastoma (GBM, WHO Grade IV, Left frontal 2.0×1.5×1.5 cm, rapidly growing toward eloquent motor cortex)	Awake Craniotomy with conscious sedation: Bilateral occipital, supratrochlear, supraorbital nerve blocks (lidocaine, epinephrine, ropivacaine), Remifentanil, Dexmedetomidine, intermittent Propofol.
Handlogten, 2015[16]	USA	Case report	1	27	20	Anaplastic oligoastrocytoma (WHO grade III, posterior superior left temporal lobe, adjacent to Wernicke area, 4.5×3.2×3.5 cm)	Awake Craniotomy: Dexmedetomidine infusion (titrated), intermittent Propofol/Fentanyl boluses, circumferential scalp block (bupivacaine + epinephrine), single low dose Mannitol (0.25 g/kg).
Kamata, 2017[17]	Japan	Case report	1	30	27	Anaplastic astrocytoma (WHO grade III, Left frontal SMA, 6 cm)	Asleep-Awake-Asleep: Sevoflurane, Remifentanil (asleep); Dexmedetomidine (awake sedation); Scalp blocks (ropivacaine, lidocaine + epinephrine).
Kaur, 2023[20]	India	Correspondence	1	26	22	Left temporal glioma near Wernicke's area, 3 2.5 4 cm	Awake-awake-awake protocol, local scalp block, 2% lignocaine adrenaline (1:2,00,000) and 0.25% bupivacaine, 15 mL each (total volume: 30 mL, minimal sedatives. Infusion dexmedetomidine was started at 0.5 μg/kg/h to target Ramsay sedation score 2.
Kumar, 2020[18]	Pakistan	Case report	1	29	13	Meningioma (Right frontal, broad based extra-axial lesion)	Awake Throughout: Scalp block (anatomical landmark technique), supplemental oxygen via nasal prongs with EtCO2 monitoring.
Meng, 2016[4]	USA	Case report	1 (twin pregnancy)	31	30	Anaplastic astrocytoma (WHO grade III, left frontoparietal white matter, 7 × 6 × 5 cm, abutting pre/post-central gyrus)	Awake Craniotomy: Propofol, Remifentanil (infusions for opening/ closure, stopped for mapping); Local anesthetic infiltration (lidocaine + bupivacaine).
Oblitas Lopez, 2023[6]	Peru	Case report	1	33	18	Diffuse astrocytoma (WHO grade II glioma, left frontal proliferative lesion)	Awake Craniotomy: Conscious sedation (Remifentanil, Propofol, Acetaminophen), scalp block (xylocaine + bupivacaine).

Contd...

Table 3: Contd...

Study Author, Year	Country	Study type	*n* patients (AC during pregnancy)	Maternal age (years)	Gestational age at surgery (weeks)	Tumor type/ location	Anesthesia/agents
Pawlik, 2018[21]	Poland	Case report with literature review	1	31	22	Left parietal brain tumor. WHO grade II astrocytoma,	Dexmedetomidine, remifentanil infusion, scalp block (ropivacaine/ lidocaine), monitored anesthesia care
Sandoval-Bonilla, 2025[19]	Mexico	Case report	1	27	19.4	Glioblastoma (GBM, WHO grade 4, IDH1 wild-type, MGMT methylated, right temporo-occipito-parietal)	Sleep-Awake-Sleep: Scalp block (ropivacaine), Fentanyl, Dexmedetomidine, intermittent Propofol. Intraoperative Brain Mapping (IBM) and IONM.

Study Author, Year	Intraop fetal monitoring	Maternal outcome	Fetal outcome	Follow-up (maternal/ fetal)	Position	Interval between craniotomy and delivery
Abd-Elsayed, 2013[3]	Yes (FHR)	Good short-term neurological status; deceased 16 months after craniotomy	Normal Apgar scores; healthy newborn	16 months (maternal)	Not mentioned	Not reported.
Al Mashani, 2018[15]	Yes (tococardiography)	No neurological deficit postoperatively.	Satisfactory fetal status; healthy.	Not specified	Left lateral	Not reported
Gunasekaran, 2022[7]	Yes (Doppler)	No complications intraoperatively; gross total resection; discharged POD 1.	Normal fetal cardiac activity intra-op; baby delivered via C-section at 34 wks (due to PPROM, concerning FHR), healthy at 5 months.	1 year (maternal MRI); 5 months (fetal)	Lateral	25 weeks
Handlogten, 2015[16]	Yes (intermittent fetal movement/ heart tones)	Uncomplicated procedure/recovery; gross total resection; no new neurological deficits.	Healthy baby delivered vaginally at term.	30 months (maternal/ fetal)	Supine	Healthy baby delivered at full term
Kamata, 2017[17]	Yes (continuous FHR)	No new neurological deficits; high arousal maintained during awake phase.	Healthy baby (2317 g) vaginally delivered at 35 wks + 2 days.	17 months (maternal/ fetal)	Supine	8 weeks
Kaur, 2023[20]	Continuous intraop fetal monitoring	Good recovery, no complications	Uneventful; normal peripartum course	Not reported	Lateral	18 weeks
Kumar, 2020[18]	Yes (pre/post-op fetal heart sounds)	Hemodynamically stable, pain-free, co-operative; complete resolution of symptoms.	Fetus viability ensured; healthy.	1 week (maternal)	Not mentioned	Not reported
Meng, 2016[4]	Yes (continuous fetal monitoring)	Significant neurological improvement POD 1 (improved fluency, naming, right arm/ leg strength); later hospice care with worsening weakness/ slurred speech.	Twin babies uneventfully delivered POD 4 under spinal anesthesia. Healthy (implied).	12 months (maternal)	Right semi lateral	4 days

Contd...

Table 3: Contd...

Study Author, Year	Intraop fetal monitoring	Maternal outcome	Fetal outcome	Follow-up (maternal/ fetal)	Position	Interval between craniotomy and delivery
Oblitas Lopez, 2023[6]	Yes (pre/post-op ultrasound)	Uneventful postoperative course; normal neurological examination without motor/sensory deficits.	Healthy newborn delivered via elective C-section at 37 weeks.	9 months (maternal); healthy newborn	Right lateral position	19 weeks
Pawlik, 2018[21]	Continuous intraop fetal monitoring	Uneventful; complete tumor resection	Uneventful; normal development	Healthy mother and fetus at follow-up	Semilateral	Not reported
Sandoval-Bonilla, 2025[19]	Yes (Doppler)	Discharged POD 5 with no complications, improvement in symptomatology; free of tumor progression at last visit.	Healthy baby delivered at full term via C-section, no complications.	Not specified	Lateral	Healthy baby delivered at full term

like radiation and chemotherapy were deferred until after delivery to minimize fetal risk.[6,7,19]

Depending on the indication, both cesarean section and vaginal delivery were chosen as delivery methods; the gestational ages ranged from 34 weeks to full term[6,7,16,17,21] and fetal outcomes were favorable in all cases, with the delivery of a healthy infant, and normal Apgar scores were reported where specified.[3,15,19] In studies with long-term follow-up, all children were reported to have normal health and development.[7,16,17] In contrast, long-term maternal outcomes were variable and depended on the underlying tumor pathology; some mothers remained in good health with no tumor recurrence,[16,17] and others experienced disease progression (depending on the nature of the tumor, i.e., high-grade gliomas), required further treatment, or hospitalization.[3,4,6]

Based on the JBI critical appraisal checklist for case reports,[9] all 11 included studies had consistent high methodological quality with clear descriptions of patient demographics, medical history, clinical insights/presentation, diagnostic findings, interventions, postintervention outcomes, and a lower incidence of adverse or unanticipated events [Table 4].[3,4,6,7,15-21]

Discussion

The occurrence of brain tumors in pregnancy is uncommon,[15] but the coexistence of a brain tumor and pregnancy presents unique diagnostic, anesthetic, and therapeutic challenges, as both maternal and fetal factors and safety need to be considered together.[3,4,6,7,18] Elective surgeries during pregnancy are usually deferred till the delivery, but in cases of brain tumors, the neurological instability and tumor growth may require urgent intervention[15] Since the extent of tumor resection of malignant glioma is a strong prognostic factor, awake craniotomy is considered a therapeutic option for pregnant patients in whom the tumor is in or adjacent to the eloquent area.[17] Awake craniotomy is considered a safe option for resection of brain lesions adjacent to the eloquent cortex to maximize excision[15] as it has unique advantages to minimize or avoid neurological complications.[4]

The essential component for successful maternal and fetal outcomes is a multidisciplinary approach that involves close communication between the neurosurgeon, neuroanesthetist, obstetrician, and patient during the decision-making process;[3,4] incorporates assistance from obstetrics–gynecology, neurophysiology, and neuropathology;[7] and includes careful perioperative planning to weigh the associated risks and benefits.[4,6]

The current literature, although suggesting that awake craniotomy is apparently a feasible and relatively safe procedure in select cases of brain tumor management in pregnancy, shows significant reporting heterogeneity across the published cases, ranging from anesthetic technique variations from "asleep-awake-asleep"[17,19] to "awake throughout,"[7,18] use of anaesthetic agents such as propofol, dexmedetomidine, and sevoflurane and follow-up duration which ranged from immediate postpartum to over a year.[4,7,16,17]

The principles of anesthetic management include appropriate preoperative investigations, adequate psychological preparation/counseling, intraoperative use of scalp block,[18] continuous monitoring of fetal cardiac activity, maintaining maternal BP to ensure adequate uteroplacental circulation,[15] IONM to preserve the maternal–fetal integrity to improve oncological outcome,[19] and surgical and neuro-oncologic

Table 4: JBI critical appraisal checklist for case reports[9]

Study Author, Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Abd-Elsayed, 2013[3] (Case 4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Al Mashani, 2018[15]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gunasekaran, 2022[7]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Handlogten, 2015[16]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kamata, 2017[17]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kaur, 2023[20]	Yes	Partially	Yes	Yes	Yes	Yes	No	Yes
Kumar, 2020[18]	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Meng, 2016[4]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Oblitas Lopez, 2023[6]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pawlik, 2018[21]	Yes	Partially	Yes	Yes	Yes	Yes	No	Yes
Sandoval-Bonilla, 2025[19]	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

Q1: Were patient's demographic characteristics clearly described?. Q2: Was the patient's history clearly described and presented as a timeline?. Q3: Was the current clinical condition of the patient on presentation clearly described?. Q4: Were diagnostic tests or methods and the results clearly described?. Q5: Was the intervention (s) or treatment procedure (s) clearly described?. Q6: Was the post-intervention clinical condition clearly described?. Q7: Were adverse events (harms) or unanticipated events identified and described?. Q8: Does the case report provide takeaway lessons?

treatment planning.[7] An understanding of the availability of safe anesthetic agents and their effects on the fetus is crucial in managing these patients.[3] For example, dexmedetomidine is a highly selective a-2 agonist with sedative, analgesic, and anxiolytic properties that has been successfully used as an adjunct in nonobstetric surgery during pregnancy.[15] It provides conscious sedation, does not cause significant respiratory depression, and reduces the need for opioids. It is particularly useful for awake craniotomies that require intraprocedural speech and motor mapping.[16] In vitro, it increases the frequency and amplitude of uterine contractions in human myometrium[22]; however, no perioperative uterine contractions have been reported in clinical cases.[16] The effects of dexmedetomidine on preterm fetuses are unclear; due to a lack of controlled human studies, it is classified as FDA pregnancy category C. Animal studies suggest no adverse impact on neuronal development.[23]

While mannitol is widely used in neurosurgery to reduce intracranial pressure, its effects in pregnancy are less established.[15] One study showed that a low dose resulted in a transient reduction in uterine volume but had no overt adverse effects on the fetus.[16] However, there is a further need for guidelines for the use of both dexmedetomidine and mannitol in pregnant patients, which are lacking.[15,16] Remifentanil is rapidly metabolized by plasma and tissue esterases with a short, duration-independent half-time of 3–4 minutes. It can cross to the fetus but causes no significant adverse effects apart from mild initial muscle rigidity.[3] However, no adverse effects associated with this opioid have been reported in the literature. It is not known whether local anesthetics like bupivacaine, ropivacaine, and lidocaine, when used for scalp blocks, can cause any harm to the fetus. Animal studies using doses of up to five times the maximum recommended human dose have not shown any evidence of teratogenicity. Dexamethasone is considered safe in these patients as it is helpful in reducing perilesional edema and helps in fetal lung maturation while reducing nausea and vomiting.[24] If required, an antileptic with minimal fetal effect should be considered due to potential teratogenic effects. Left uterine displacement should be preferred to avoid aortocaval compression in advanced pregnancy.

The key limitation is the risk of selection and publication bias as case reports usually highlight successful or unusual outcomes; such predominantly positive maternal and fetal outcomes may not reflect all cases, particularly complications, and additionally, there is an absence of control groups (e.g., general anesthesia), limiting their causal conclusions. As no comparative studies are available, the existing evidence does not allow conclusions regarding superiority over general anesthesia. Many commonly used agents require further evidence for their safety during pregnancy, including the potential benefits, doses, and safety of dexmedetomidine in the obstetric population[16] and the usage, dosage, and safety of mannitol during pregnancy.[16] However, as the evidence is largely based on case reports and a small case series, statistical analysis is of limited value and findings remain descriptive and hypothesis-generating rather than definitive; hence, they have low evidence quality and potential publication bias.[3,4,6,7,15-19]

Conclusions

In the current literature, the management of brain tumors during pregnancy with the use of awake craniotomy is largely based on case reports. Although reported cases suggest feasibility and favorable neonatal outcomes, there is limited evidence which cannot establish definitive safety or comparative benefits. However, most reports were well documented and provided detailed clinical presentations, imaging, procedures, and outcomes, including the extent of tumor resection, neurological status, and neonatal health,

along with good anesthetic and intraoperative details. In view of the inherent limitations of case reports, there is a need for large-scale studies to determine the potential risks and benefits, safety, and long-term maternal/fetal outcomes of this approach in pregnant patients.

Availability of data, code, and other materials

Available on request.

Appendices

AC - Awake craniotomy

FHR. - Fetal heart rate

IONM. - Intraoperative neurophysiological monitoring

JBI. - Joanna Briggs Institute

MAC - Monitored anesthesia care

PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses

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Conflicts of interest

There are no conflicts of interest.

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