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Original Research Article

Anesthetic Management for Caesarean Section of Pregnant Women Carrying a Brain Tumor

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Abstract: The purpose of the study was to evaluate the anesthetic management for caesarean section of women during pregnancy with a cerebral tumor. It is a retrospective study which was done at the department of neurosurgery of the University Teaching Hospital of Fann and at the department of obstetrics of the University Teaching Hospital of Pikine in Dakar, from July 1ST, 2008 to June 30th, 2015, and included all patients hospitalized for cerebral tumor and presenting an evolutive pregnancy and to whom a caesarean section was done or had been regarded as a possibility. In results We identified 6 cases of cerebral tumor in pregnancy. They presented 2.7 % of all cerebral tumors in women. The average age on diagnosis was 28.2 years. On the whole, the approach was conservative towards the pregnancy and interventionist for the cerebral tumor. The timing for the caesarean section was decided in a collegian faction. Four of the 6 patients underwent a caesarean section after foetal maturation. They all presented intracranial hypertension sighs and general anesthesia was preferably indicated instead of peri medullary anesthesia .The aims of the anesthesia were to avoid foetal distress and the occurrence or aggravation of intracranial hypertension. These two goals contrast each other in practice. Neuroprotective measures were applied after foetal extraction. The caesarean section allowed the birth of live and healthy new borns. The excision of the tumor follows few days later. One of the patients presented a bulky and inoperable cerebral tumor and expired during the management. In conclusion the occurrence of a cerebral tumor during pregnancy is rare but not an exception. The choice of the anesthetic technique for foetal extraction by caesarean section must be adapted in order to preserve the maternal and fetal prognostic.
Keywords: Anesthesia, Caesarean section, cerebral tumor.

INTRODUCTION

The occurrence of a pregnancy in a patient carrying a brain tumor or diagnosing a brain tumor during a pregnancy is two rare and sensitive events [1]. What is at a stake in the anesthesia for a caesarean of a pregnant woman with a brain tumor is to avoid any fœtal suffering and to limit the lesions 'aggravation during fœtal extraction in order to provide the maximum chances of neurological recovery after the treatment of the tumor. The objective of our work was to assess, in a tropical environnement, the anesthetic handling of a caesarean section (C-section) for pregnant women carrying a brain tumor.

PATIENTS AND METHODS

This was a retrospective study conducted in the neurosurgery clinic of Fann Teaching Hospital and the gynecology and obstetrics department of Pikine Teaching Hospital in Dakar over a period going from July 1st, 2008 to June 30th, 2015. It concerned all female in patients for whom a diagnosis of brain tumor over an evolving pregnancy had been evoked based on clinical criteria and confirmed by brain CT scan associated to obstetrical examination and obstetrical echography. The patients' handling was done in a multi-disciplinary framework which associated neurosurgeons, obstetricians and anesthesia-resuscitation specialists. Based on hospital files, we studied various therapic schemes possible in such kind of association, namely : in a first phase, a therapic interruption of pregnancy and then tumor exeresis; surgical treatment of the tumor, then foetal extraction by vaginal birth or by C-section ; or, finally, performing a C-section after fœtal maturation, then tumor exeresis. Similarly, we studies the management of pre-surgical treatments colliding with the after effects of teratogenicity, choosing between general anesthesia and peri medullary

anesthesia during C- section and the evolving particularities after C-section.

RESULTS

We recorded 6 patients showing associated brain tumor and pregnancy among 217 women carrying a brain tumor that is a 2.7% frequency. Patient average age was 28.2 years+/- 12.4 [18 - 38 years]. The brain tumor had shown during the first quarter for 2 patients, during the second quarter for 3 patients and during the last quarter for one patient (fig 1). Clinical signs related to the brain tumor were predominantly high intracranial pressure found among all patients and hemi corporeal deficit observed on 4 patients (fig 2). Table I shows the various tomodensitometrics aspects observed among our patients. EEG was performed on 4 patients and showed irritating cortical abnormalities on normal level basal activity. The medical treatment (fig 3) which was an adjuvant means for handling brain tumors comprised paracetamol per-os (1g x 4/d) for all patients, in association with tramadol hydrochloride per-os (50 mg x 3/d) for 3 patients ; carbamazepine 400 mg (1/2 tablet x 2/d) prescribed to 2 women during the second quarter of pregnancy. All patients had undergone corticosteroid therapy based on methylprednisolone iv (120mg x 2/d) during 3 days, then 80mg/d by intravenous administration during 02 days. The per os relay was done with prednisolone 20mg (1tablet/d). The corticosteroid therapy was meant to reduce the epi-tumoral oedema and accelerate foetal maturation. All established treatments were pursued until after tumor exeresis. The timing of the C-section was discussed collectively. For all cases, a conservative attitude was agreed upon regarding the foetus.

Two patients, one at quarter one and the other at quarter two, underwent a ventricular cysternostomia, an endoscopic gesture under general anesthesia which allows connecting the lateral ventricles with the cisterns at the base of the brain, thus creating an internal diversion of the cephalo spinal fluid (CSF). This gesture considerably improved the high intracranial pressure symptomatology. The C-section was performed later, respectively at the 30^{th} and the 32^{nd} WA under general anesthesia. It allowed for the birth of healthy male and female newborns. Surgical exeresis of the tumor followed one week later.

For 2 patients admitted during the second quarter, medical treatment has allowed the pregnancy to continue without any major problems. The C-section was performed for one patient at the 28^{th} WA and the other one at the 30^{th} WA under general anesthesia. The C- section has allowed the birth of live and fit male newborns. Tumor exeresis was performed a score of days later.

The second patient admitted at quarter one of pregnancy had a spontaneous abortion at the 17^{th} WA. This abortion was marked by an improvement of the neurological picture. Tumor exeresis was performed a fortnight later.

The sixth patient showed a voluminous olfactory meningioma extending in depth, exercising a mass effect with a deviation of the midline structures. This was a non surgical tumor. Death occurred at the 20^{th} WA in a very dramatic context of seizures. Therapic behavior was to perform a C-section after foetal maturation.

For all C-sections, a rapid sequence induction was carried out associating thiopental (3mg/kg), succinylcholine (1mg/kg) and a Sellick manipulation. After the foetal extraction, fentanyl (3µg/kg) and vecuronium (0,1mg / kg) were injected. Isoflurane had allowed anesthesia maintenance, but with minimal alveolar concentration (MAC) reduced by 50%. After foetal extraction, maintenance was done with propofol. Pupil monitoring was performed to detect any acute neurological suffering. For all patients, neuroprotective measures were adopted which associated a slightly proclive position by 30° of the operating table, with the patient's head in an upright position, current volume adjustment of the respirator at 6ml/kg, and anesthesia maintenance with propofol. In post-surgical period, all patients were admitted in intensive care unit. Post-surgical analgesia was associating paracétamol iv (1g/6h) and tramadol iv (400mg/24h). Thrombo prophylaxis was started at H_{12} with enoxaparin (0, 1 UI/kg/24h).

Post surgical neurological complications, highly feared, were only found on one patient who had shown on post-surgical D_1 a severe picture of high intracranial pressure resisting to methylprednisolone boil and to mannitol perfusion. The indication for tumor exeresis was immediately advocated. There was a favorable evolution.

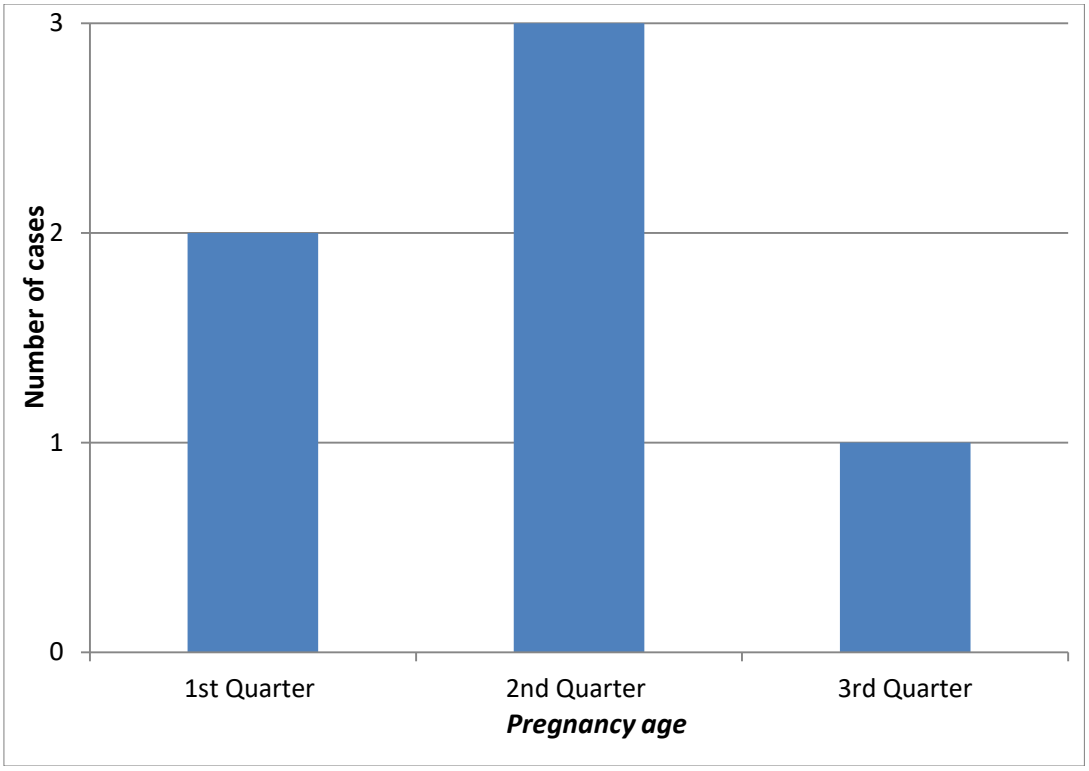

Fig 1: Patients distribution by pregnancy age

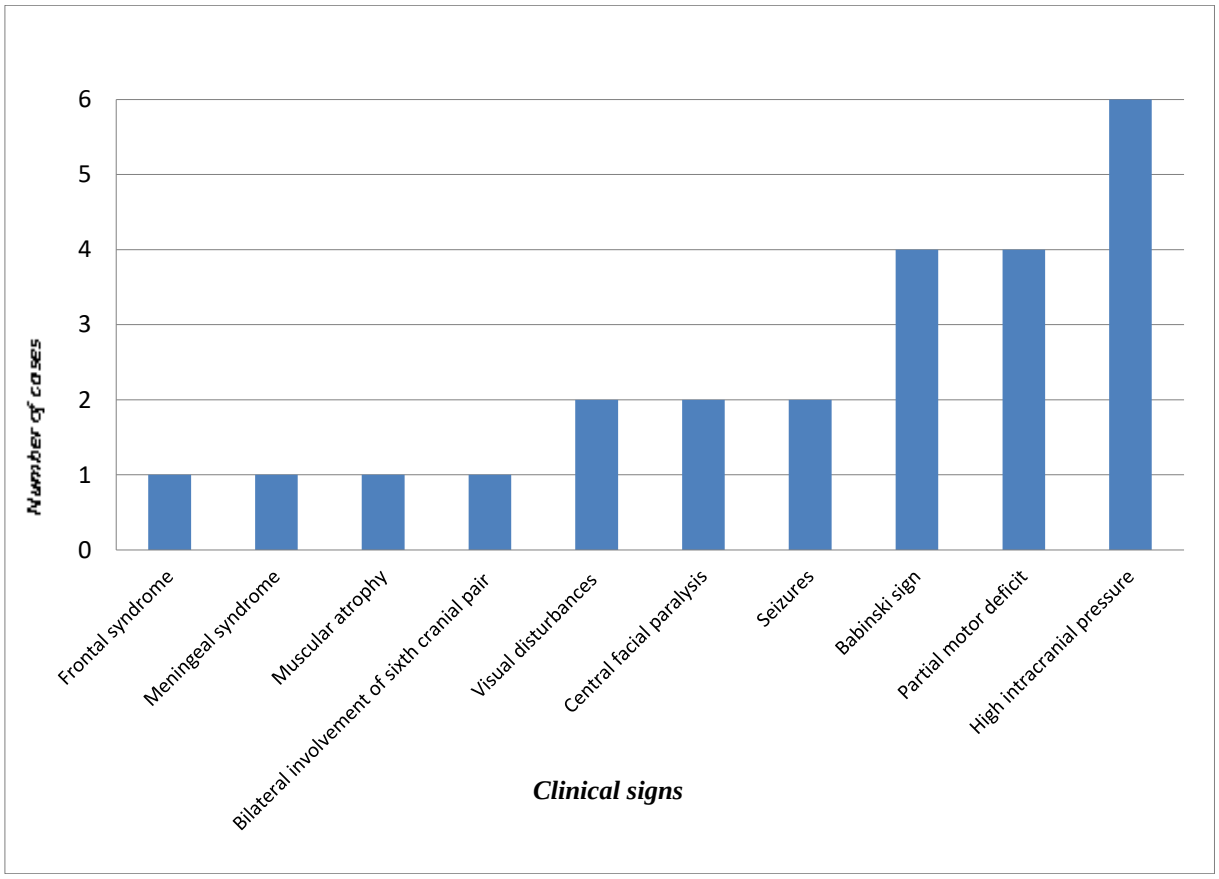

Fig 2: Patients distribution by clinical signs

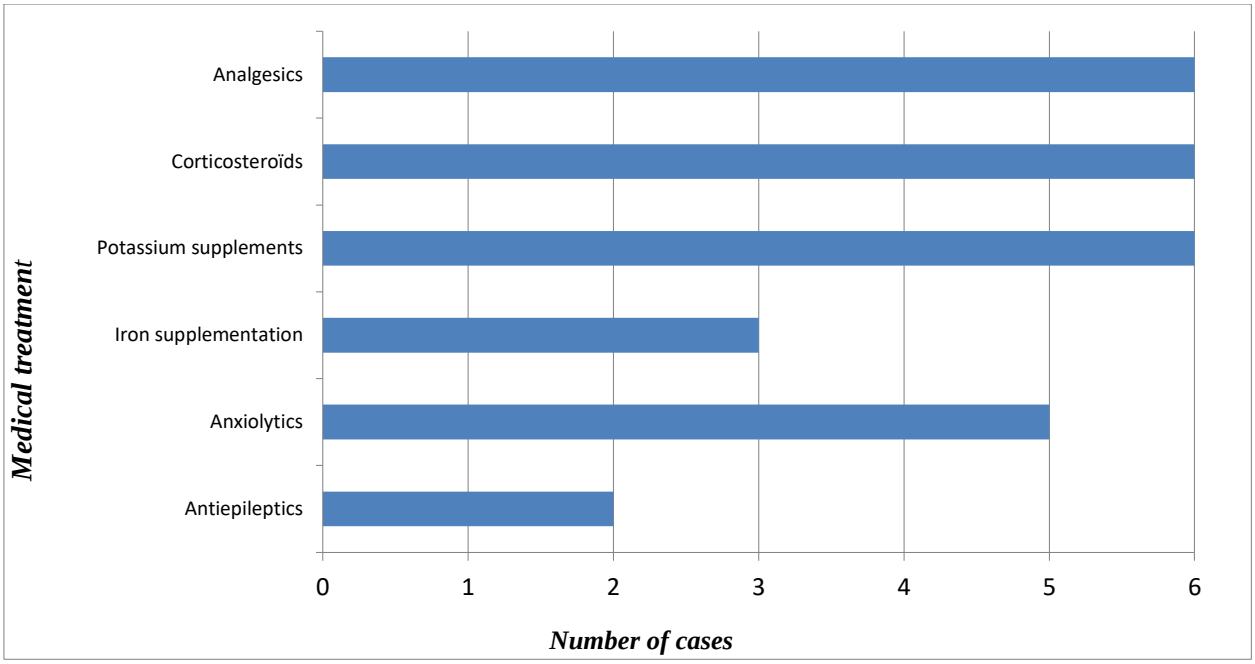

Fig 3: Patients distribution by medical treatment.

Table 1: Patients distribution by TDM aspects

TDM aspects	Number of cases
Astrocytoma	01
Pineal tumor	01
Glioblastoma	01
Méningioma	03

DISCUSSION

The simultaneous occurrence of a brain tumor and a pregnancy is rare, since the average age for the occurrence of most cancers is beyond child-bearing age. We found a 2.7% frequency in our study. Sif and Depret-Mosser have found respectively one brain tumor for 9,705 and 20,000 pregnancies [2, 3]. Many studies conducted on the association of a brain tumor with a pregnancy are characterized by the small size of the series, as shown by Aaron who, over a 36-year period found an annual frequency of 0.38 case / year [4].

Pregnancy is an aggravating factor of brain tumors through tumor growth activation by stimulation of tumor receptors due to pregnancy hormones, œstrogens and progesterone; through the increase of the epi-tumoral oedema due to the increase of blood circulation volume and the maternal vascular clogging; and finally, through the immuno-tolerance which is coterminous with pregnancy [4,5]. Apart from pituitary adenomas, a brain tumor does not exercize any effect on the unravelling of pregnancy or on the sustainability of the fœtus. However, the nature of the tumor has a clear bearing on maternal and fœtal prognoses. Relvink and Yerby consider the malignant nature of the tumor, the sub-tensor location due to the sudden high intracranial pressure it may generate and the existence of associated seizures [6,7].

The anesthetic handling will take into consideration the principles of the brain's physiology and the physiological modifications related to pregnancy. Management of pre-surgical treatments, namely anticonvulsant drugs, faces the after effects of teratogenicity. It has been demonstrated that a single tonic clonic seizure could lead to in-utero death and that the occurrence of a generalized state of illness came with a high death rate both among mothers and chidren [7]. Carbamazepin was prescribed to two patients during the 2nd quarter. Prescription of the weakest effective dose and choosing a monotherapy instead of associating several molecules are the therapic options to be favored in such context [7, 8, 9]. Corticosteroid therapy was part of the medical treatment of high intracranial pressure by reducing the epi-tumoral oedema volume. It also allowed for an acceleration of fœtal maturation. Choosing bethametasone seems better than methylprednisolone and dexamethasone [10]. The timing of the C-section was decided on a case by case basis in a collective manner. Several scenarios are possible. For those brain tumors diagnosed during the first weeks of pregnancy, tumor exeresis can be

performed and delivery will follow later either by vaginal birth or C-section. For those tumors diagnosed during the second quarter, delivery is possible after fœtal maturation by C-section but also by vaginal birth, in the absence of high intracranial pressure. In case of acute neurological distress engaging maternal prognosis, tumor exeresis is performed in emergency, followed by fœtal extraction by way of a C-section [7, 10].

To date, there is no formal recommendation as regard C-section timing in case of an expansive process over an evolving pregnancy [10]. It is preferable to delay the neurological operation until after delivery or C-section. The C-section is performed in the wake of close maternal monitoring until the fœtus has matured. The key objectives of anesthesia are to avoid any fœtal suffering and the occurrence or aggravation of a high intracranial pressure. These are two opposite aims in practice. General Anesthesiea does expose the mother to the risk of a difficult intubation, and to that of a bronchial inhalation which may be the source of an intracranial pressure increase. High intracranial pressure could also occur in case the anesthesia is not deep enough. Hemodynamic variations will induce distrubances in the pressure of the brain perfusion. As for the fœtus, low arterial blood pressure, hypoxemia and maternal acid-basic disorders will be the source of fœtal suffering. For the choice of drugs, it is necessary to protect two types of blood circulation, in the brain and the fœtus that operate differently. Thiopental is the chosen anesthetic agent for patients suffering from high intracranial pressure. Propofol and etomidate reduce intracranial pressure, but in a lesser way. The risk of increase in intracranial pressure after administering succynylcholin is exagerrated for some authors, given its wide use among neurotraumatized patients without any obvious complications [11]. On induction, the impossibility of injecting fentanyl which allows avoiding the sympathic responses linked to laryngoscope may be offset with lidocain instillation at glottic level 60 to 90 seconds before intubation [12]. After fœtal extraction, halogenates, among which the MAC, are reduced by 50%, are stopped and maintenance is ensured by propofol. As a matter of fact, maintaining anesthesia solely with propofol in such context of high intracranial pressure was the best indication. But its neurological and ventilatory foetal repercussions were a couter-indication to its use as a first line treatment, but not after foetal extraction. Reducing the halogenates' MAC is justified by their vasodilatory properties for the brain. Using isoflurane with our patients could be explained by its lesser cost as compared to that of sevoflurane which is poorly vasodilatory. During general anesthesia, neuroprotective measures should be applied in order to avoid any brain suffering. Among such measures, one is to obtain a deep anesthesia with a bispectral index (BIS) comprised between 30 and 40, a fraction of exhaled CO_2 ($EtCO_2$) comprised between 32 and 34 mm/hg, a slightly proclined positioning of the operation table, with the patient's head in an upright position, and administration of mannitol 20% (0,2g/kg in 10mm) in case of change in pupils' diameter. All of these measures can only be applied after the fœtus is extracted. Epidural anesthesia provides the benefit reducing perioperative morbidity and mortality [13]. It allows maintaining awareness and does not affect the brain's functions. It should be performed on a cool, calm and collected patient, in order to avoid any raise in intracranial pressure due to stress. The main risk incurred by the patient in case of epidural anesthesia is dural tear. Leaking CSF causes a sudden change in intracranial pressure which may be the source of cerebral herniation and engage the mother's vital prognosis. Epidural anesthesia is therefore counter-indicated in case of high intracranial pressure [10]. Even in the absence of high intracranial pressure, the occurrence of a dural tear, which remains possible with an experienced anesthetic specialist, could have unpredictable neurological effects for the mother. Su has reported one case of maternal death by engagement after a dural tear [13]. All these considerations have strongly supported our choice for general anesthesia. Even though general anesthesia remains the most widely used mode of anesthesia for C-section in associated brain tumor and pregnancy, epidural anesthesia is still practiced in many instances [14]. Spinal anesthesia, because of the CSF substraction it entails, is formally counter-indicated. One case of spinal anesthesia for C-section over a brain tumor was reported by Hirs [10]. But in this specific case, the patient had one ventricular peritoneal derivation drain for CSF in place. And for the latter, installing a ventricular peritoneal derivation drain for CSF allows for vaginal delivery or any type of epi-medullar anesthesia in case of C-section.

CONCLUSION

Anesthetic handling for C-section on a woman carrying a brain tumor is a challenge for the anesthesia specialist, with regard to the complexity of the close links between physiological changes relating to pregnancy and brain physiology. General anesthesia remains the most widely used mode of anesthesia. Epidural anesthesia is performed in many cases. But it still remains counter-indicated in case of high intracranial pressure. It will have to be performed carefully with a view to avoiding any dural tear that may involve the mother's vital prognosis.

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