OPIS PRZYPADKU / CASE REPORT
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Optimization of anaesthesia care for "total" awake craniotomy with brain tumour resection in a pregnant patient. A case report with a review of the literature

Optymalizacja opieki anestezjologicznej do zabiegu kraniotomii z resekcją guza mózgu w pełnej przytomności u ciężarnej chorej. Opis przypadku z przeglądem piśmiennictwa

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Abstract

Background. A pre-delivery urgent brain tumour resection may be required if a rapidly growing lesion is having a massive effect. Awake craniotomy is indicated for procedures requiring intraoperative cortical language and sensorimotor stimulation mapping. Speech function monitoring in a conscious and responding patient allows the evaluation of neurological dysfunction before the removal of tissue in order to minimize the risk of neurological complications. ***Case report.*** We describe a total awake craniotomy for the resection of a left parietal brain tumour with intra-procedural speech mapping in a 31-year-old woman in the 22nd week of gestation. Throughout the surgical procedure, the patient was in monitored anaesthesia care (MAC) at minimal and moderate sedation. Intraoperative analgesia was maintained with infusion of remifentanil and a scalp block placed preoperatively using ropivacaine and lidocaine. Sedation was maintained with dexmedetomidine. ***Conclusion.*** No negative maternal or foetal side effects were noted during the intraoperative and (hospital) postoperative period. *Anestezjologia i Ratownictwo 2018; 12: 70-74.*

Słowa kluczowe: awake craniotomy, scalp block, deksmedetomidyna, intra-procedural speech mapping

Streszczenie

Wstęp. Szybko rosnące nowotwory mózgu u ciężarnych z narastającym efektem masy, mogą być wskazaniem do pilnej resekcji przed rozwiązaniem ciąży. Kraniotomia z wybudzeniem jest dedykowana do procedur wymagających śródoperacyjnego monitoringu kory czuciowo-ruchowej i ośrodków mowy. Monitorowanie funkcji mowy u przytomnego chorego umożliwia oszacowanie ewentualnych dysfunkcji neurologicznych przed usunięciem tkanek i zminimalizowanie ryzyka pooperacyjnych komplikacji neurologicznych. ***Opis przypadku.*** Przedstawiamy opis kraniotomii z pełnoczasowym wybudzeniem do resekcji guza lewego płata ciemieniowego mózgu ze śródoperacyjnym mapowaniem ośrodka mowy u 31-letniej kobiety w 22 tygodniu ciąży. Przez cały okres zabiegu u pacjentki prowadzona była monitorowana opieka anestezjologiczna (MOA) z minimalną lub umiarkowaną sedacją. Analgezję śródoperacyjną uzyskano wlewem remifentanylu i przedoperacyjnym wykonaniem blokady typu „scalp block" z użyciem ropiwakainy i lidokainy. Sedacja była podtrzymana wlewem deksmedetomidyny.

Wyniki. Zarówno w okresie okołooperacyjnym jak i trakcie hospitalizacji po zabiegu nie obserwowano efektów niekorzystnych u ciężarnej i płodu. *Anestezjologia i Ratownictwo 2018; 12: 70-74.*

Keywords: kraniotomia z wybudzeniem, scalp block, dexmedetomidyna, mapowanie korowe ośrodków mowy

Introduction

Primary brain tumours do not often occur during pregnancy [1], which may actually accelerate the growth and the unmasking of a previously existing intracranial tumour [2]. Some primary tumours (eg. meningiomas) grow faster during pregnancy, as they may contain oestrogen and progesterone receptors [3].

Urgent pre-delivery brain tumour resection may be required if a rapidly growing lesion is having a massive effect and is causing neurological destabilization [2,4]. There are only a limited number of publications on the peri-operative management of brain tumour removal in pregnancy and suggested guidelines are few and far between [4,5].

Awake craniotomy greatly facilitates intraoperative cortical mapping, which is needed in order to remove the maximum amount of brain lesion without impairing neurological speech function [6,7]. The most critical aspects of appropriate awake craniotomy are the maintenance of adequate sedation and analgesia for the patient's comfort, cooperation during protracted surgery and awake mapping, immobilization, bladder catheterization, arterial and venous accesses, immobilizing the head in a Mayfield frame and other potentially painful procedures. The anaesthetist should pay attention to specific problems during awake craniotomy: difficult emergency intubation, seizures, haemorrhage, intracranial hypertension, agitation and lack of cooperation. It is vital that the patient is actively involved in the procedures and pre-operatively informed about their bothersome aspects – and what she can expect to see and hear [6,8,9]. Brain tumours in pregnant patients may put both the mother and the foetus at risk. A multidisciplinary and collaborative effort is therefore crucial.

Presentation of a case report

A 31-year-old woman in the 22nd week of gestation presented for left parietal awake craniotomy requiring intra-procedural cortical speech mapping and tumour resection. During the neurological examination, she had exhibited word-finding difficulty. The MRI showed a left parietal tumour. A meticulous MRI analysis revealed that is was a WHO grade II astrocytoma, though WHO grade III could not be excluded. On the day before surgery, the patient was informed about bothersome aspects of the procedure and what she could expect to see and hear. Pre-operatively (in the pre-op unit), a prophylactic antibiotic, magnesium sulfate and ondansetron were administered, two IV catheters were inserted and a radial arterial catheter was inserted in a local skin infiltration of 1ml 1% lidocaine under ultrasound guidance. Intra-operatively, the patient was in monitored anaesthesia care (MAC). This involved the use of a pulse oximeter, a continuous electrocardiogram and invasive blood pressure monitoring. Depth of sedation and consciousness were assessed using the Ramsay Sedation Assessment Scale (10 min intervals) and Bi-Spectral Index monitoring (BIS) with continuous EEG wave control – along with SR (suppression ratio) monitoring [10]. Our patient was positioned semi-laterally in order to reduce the risk of aortocaval compression. A warming blanket was used to keep her warm and she received supplemental oxygen via a nasal cannula.

Dexmedetomidine was infused at 0.4 to 0.7 mcg/kg/h without a loading dose, while remifentanil was administered in a target-controlled infusion (TCI) with an effect-site concentration of 1 to 2.0 ng/ml. The dexmedetomidine infusion was increased to up to 1.0 mcg/kg/h and remifentanil to up to 3-4 ng/ml as needed for mitigating events such as scalp block infiltration, head immobilization in a Mayfield frame, skin incision, bone flap removal, dural opening and the placement of a urinary catheter. Moderate general muscle rigidity was observed at the beginning of the remifentanil infusion. A bilateral six-point scalp block was placed using 15 ml of 1.0% ropivacaine and 15 ml of 1.0% lidocaine with 1:400000 epinephrine. Speech mapping included naming, counting, reading and repeating during cortical stimulation. The patient was awake and cooperative throughout the surgery. The total time spent in the operating theatre was 4 hours and 40 minutes. The patient withstood the procedure without any problems and

remembered almost all the stages of the peri-operative period. The RSAS score was 2-3, while the BIS range was 60-96 (mean 82) during the entire surgical procedure. Obstetric abdominal ultrasound examinations were performed before surgery, immediately after surgery (in the post-anaesthesia recovery unit) and also on the following day. They showed no foetus or intrauterine volume abnormalities.

Discussion

The use of dexmedetomidine for sedation during pregnancy

Dexmedetomidine is a highly selective, short--acting α2-adrenoceptor agonist with an α2 : α1 selectivity ratio of 1620:1 [11]. It may be used for anxiolysis, sedation and analgesia. It would seem to provide sedation that is closer to natural sleep and reduces the need for opioids. At doses used for sedation it does not cause significant respiratory depression [12-14]. All this makes it an appropriate sedative drug for awake craniotomy. In vitro it has been found to enhance the frequency and amplitude of uterine contractions in human myometrium [15]. Although this effect is undesirable in pregnant patients undergoing non-obstetric surgery, no regular uterine contractions during the peri-operative period have been observed in other case reports [5]. The effects of dexmedetomidine on the pre-term foetus have not been sufficiently well described. As no properly controlled studies of its use in pregnant women have been published, the FDA has assigned it to pregnancy category C. In some animal studies. dexmedetomidine does not appear to have any impact on neuronal development [16].

- **The use of remifentanil during pregnancy:**

Remifentanil is rapidly metabolised by plasma and tissue esterases and can be redistributed to both the mother and the foetus. Its short CSHT (context--sensitive half-time) of 3-4 minutes is independent of the duration of the infusion.

Apart from moderate muscle rigidity at the beginning of the infusion, remifentanil did not produce any adverse effects in our case or in any other published cases [4].

Local anaesthesia of the sensory nerves of the scalp prevents a haemodynamic response to head pin placement and pain during craniotomy. It is referred to as a "scalp block". Sensory innervation of the scalp and forehead is provided by the trigeminal and spinal nerves. For proper awake craniotomy, a bilateral 6-nerve block is necessary, the relevant nerves being the supraorbital nerve, the supra-trochlear nerve, the zygomaticotemporal nerve, the auriculotemporal nerve, the greater occipital nerve and the lesser occipital nerve.

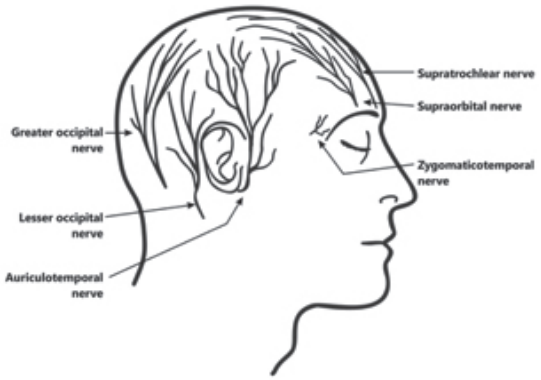

Figure 1 Innervation of the scalp
Source: collaborator. Authorization obtained from K. Szczupak to use this material

After skull pin placement with a Mayfield frame, there may be an increase in the bi-spectral index monitoring values, the haemodynamic parameters and the risk of intracranial hypertension. Bithal et al. have shown that these changes can be prevented by pre-pinning infiltration with a local anaesthetic [17]. It is not known whether ropivacaine and lidocaine can cause any harm to the foetus. The FDA has assigned them to pregnancy category B. Animal studies using doses of up to five times the maximum recommended human dose have not shown any evidence of teratogenicity.

- **The use of mannitol during pregnancy**

The management of intracranial hypertension during neurosurgical procedures includes the infusion of mannitol. However, there are no well-established guidelines for the use of diuretics during pregnancy. Mannitol can cause maternal dehydration, leading to foetus hyperosmolality and a decrease in foetal lung fluid and urine production. An additional concern is that the significant changes in intravascular volume which are produced by the use of mannitol may increase the probability of uterine contractions.

Handlogten et al. have reported that a low dose (0.25 g/kg) of mannitol does not appear to have any adverse effects on the foetus when administered during craniotomy in mid-gestation pregnancy. A reduction of

Table I. Review characteristics

Study	Age	Gestational age at craniotomy [weeks]	Local anaesthetic infiltration/ scalp block	MAC – anaesthetic management	Pathology
Handlogten et al. Anesth Analg. 2015	27	20	0.25% bupivacaine	Dexmedetomidine/ Propofol/Fentanil	N/A
Lingazhong et al. J Clin Neurosci 2016	31	30	0.5% lidocaine: 0.25% bupivacaine 1:1	Propofol/Remifentanil	Grade III astrocytoma
Abd-Elsayed et al. F1000Res. 2013	40	22	N/A	Propofol/ Alfentanil	Glioma
	30	N/A	N/A	Propofol/ Dexmedetomidine	Low grade glioma
	34	N/A	N/A	Propofol/ Dexmedetomidine	Low grade glioma
Al. Mashaniet al. J Neurosurg Anesthesiol 2017	26	10	1% lidocaine: 0.25% bupivacaine 1:1	Propofol/Remifentanil/ Dexmedetomidine	N/A

MAC/MOA – monitored anaesthesia care/monitorowana opieka anestezjologiczna, N/A – not available

intrauterine volume – which later returned to normal over a period of 48 hours – was not associated with any recognized negative effect for the foetus [5]. According to Wang, mannitol doses of even up to 0.5 g/kg have been reported with good outcomes [9].

- **A review of the literature**

The authors carried out a systemic search of articles written in English that are to be found in the Cochrane library and PubMed database 1/2007-12/2017 (table I). The search included observational trials, reviews of the literature and case reports dealing with the management of the resection of brain tumours in pregnant patients under awake craniotomy without general anaesthesia.

In the very limited number of such cases that have been reported to date, we found certain inconsistencies in the anaesthesia / analgesia protocols.

In all the articles included in our review, peri-operative anaesthesia and analgesia care were managed by MAC alone or with local anaesthesia. Four cases reported by Abd-Elsayed et al. were excluded because of the use of general anaesthesia. Monitored anaesthesia care in the form of safe conscious sedation with effective pain control and measures to allay the patient's anxiety can give rise to fewer physiological disturbances and ensures a more rapid recovery than is the case with general anaesthesia [18]. In our opinion, MAC is a better option than asleep-awake-asleep anaesthesia (AAA) with general anaesthesia care during the asleep parts for an awake craniotomy in pregnant patients.

Conclusions

Because of its "neuroprotective" effects, awake brain tumour resection with cortical speech mapping should be considered even in patients who are pregnant. In this article, we have given a brief description of the anaesthetic management of an awake craniotomy with the use of dexmedetomidine, remifentanil and a "scalp block" in a pregnant woman.

A good knowledge of possible complications and the effects of anaesthetics on the patient and the foetus is crucial for the proper management of pregnant patients requiring craniotomy. Close cooperation between the anaesthetist, the neurosurgeon, the obstetrician, the neurological speech therapist and the patient is essential.

Konflikt interesów / Conflict of interest
Brak/None

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