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INFLUENCE OF GASEOUS OZONE AND MAGNETIC - INFRA-RED - LASER RADIATION ON REGENERATION PROCESSES IN WOUNDS AT ANIMALS OF THE DIABETES

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ABSTRACT:

In experiment efficiency of the combined application of ozone and magnetic-infra-red-laser radiation in treatment is proved is long not healing wounds on a background of a diabetes. That presumes to apply the given method of treatment of wounds and ulcers at patients with purulent form of a syndrome diabetic foot in clinical conditions.

Key words:

diabetic stop, ozone, magnetic-infra-red-laser radiation

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MINIMALLY INVASIVE TECHNIQUE FOR THE MANAGEMENT OF INTRAVENTRICULAR TENSION PNEUMOCEPHALUS

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ABSTRACT

Tension intraventricular pneumocephalus is associated with increased intracranial pressure, blockage of cerebrospinal fluid circulation and causes rapid neurological deterioration requiring emergent intervention. We present a case that illustrates the principles of innovative minimally invasive technique for the management of pneumocephalus complicated by asymmetric hydrocephalus, in light of cerebrospinal fluid pathophysiology and dynamics.

Key words:

Tension intraventricular pneumocephalus, hydrocephalus, cerebrospinal fluid dynamics

Introduction

Pneumocephalus is referred to the presence of air in the brain. It may be caused by traumatic injury of the skull bone [8], surgery [2], infection [5], radiation [1], or neoplasm [9]. It is estimated that head injury and cranial surgery accounted for 74% cases of pneumocephalus, and tumors for 23% [7]. Tension intraventricular pneumocephalus, a rare form of pneumocephalus, is the presence of intraventricular gas under pressure. It is associated with increased intracranial pressure and causes blockage of cerebrospinal fluid (CSF) circulation, requiring emergent surgical intervention [3, 4, 9]. Various surgery techniques have been used for the management of pneumocephalus [1, 3, 7]. We present a case where innovative minimally invasive technique was used to treat this life-threatening intracranial complication.

Case report

In 21 May, 2004 an 11 year-old male presented to the neurosurgical department with complains of severe intermittent headache, nausea, vomiting, dizziness and unsteady gait for 2 months. On admission, the patient was conscious, oriented, emotionally liable, and aggressive. Neurological examination revealed symmetrical hyperactive deep tendon reflexes, impaired upward gaze, positive Rombergs sign and unclear execution of finger-nose test on the left. Ophthalmoscopy showed edematous discs of both optical nerves. Computerized tomography (CT) revealed pineal body tumor with compression of the aqueduct of Sylvius. The third and lateral ventricles were sharply dilated with marked periventricular edema (Fig. 1 a, b).

Surgery was performed in 2 June 2004 and involved trepanation of the posterior cranial fossa and infratentorial approach, removal of the pineal body tumor utilizing ultrasound destructor, bipolar coagulation, microscope and microsurgical technique. The tumor growth was infiltrative and it

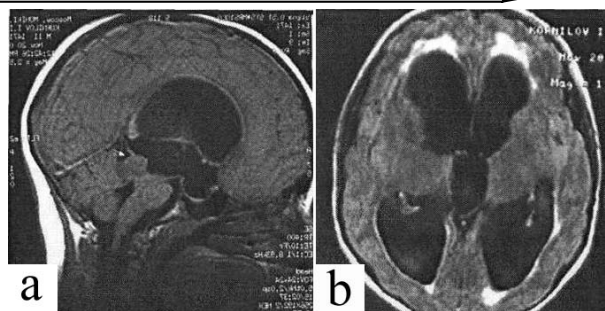


Fig. 1. Preoperative CT of the head: a – pineal body tumor with compression of the aqueduct of Sylvius; b – third and lateral ventricles are sharply dilated with marked periventricular edema

was removed within visual borders. During the operation passage of CSF was restored. Subsequent histology identified the lesion as germinoma.

Intensive gemostatic and metabolic therapy was conducted post-operatively. However, the patient became progressively lethargic. Repeated CT revealed bilateral intraventricular pneumocephalus and occlusive hydrocephalus (Fig.

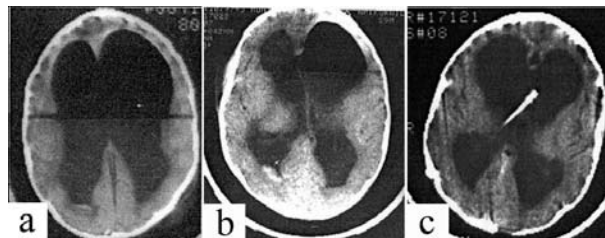


Fig. 2. Postoperative CT of the head: a – bilateral intraventricular pneumocephalus and occlusive hydrocephalus; b – asymmetric left sided intraventricular pneumocephalus with midline shift, and «air-bell» sigh; c – complete resolution of pneumocephalus with a VP shunt in situ.

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2a). In 5 June 2004, the patient was taken to the operating room, where a CT guided aspiration of intraventricular pneumatocele was performed through the puncture of the right anterior horn. Immediately after operation the patient felt well and fit, but on a second day his condition drastically deteriorated to the comatose. CT scan revealed asymmetric left sided intraventricular pneumocephalus with midline shift, and «air-bell» sigh (Fig. 2b).

Returning to surgery in 7 June 2004 we utilized the innovative technique for the management of intraventricular pneumocephalus (Fig. 3). The technique is performed as follows: the patient rests on his back, burr holes are produced bilaterally for the puncture in anterior or posterior horns, the anterior horn 2 of the lateral (left) ventricle 3 is punctured with a canulla 1, anterior horn 4 of the lateral (right) ventricle 5 is punctured with two canullas 6, 7, one of which 6 is placed in the cavity of the body of lateral ventricle 5, and another 7 is placed as close as possible to the upper wall of lateral ventricle 4, in the air cavity 8. The physiological solution by means of a syringe through the canulla 6 is infused slowly in air cavity 8, gradually filling it. The residing intraventricular air is displaced from air cavity 8 through the canulla 7. The infused fluid reaches the foramen of Monroe 9, fills the third ventricle 10, displacing the air from it, and then moves to the opposite lateral ventricle 3. The complete removal of air is checked by the release of the physiological solution from the canullas 1 and 7. In a control craniography, no residual air was observed.

At the same time the patient undergone ventriculo-peritoneal shunting to prevent CSF blockage. The symptoms resolved and no further problems were encountered. Post-operative CT showed complete resolution of pneumocephalus (Fig. 2c). The patient was discharged in 25 June 2004 and received course of radiotherapy on outpatient basis. On a follow-up in 2005 and 2006 the patient remained well with no complications.

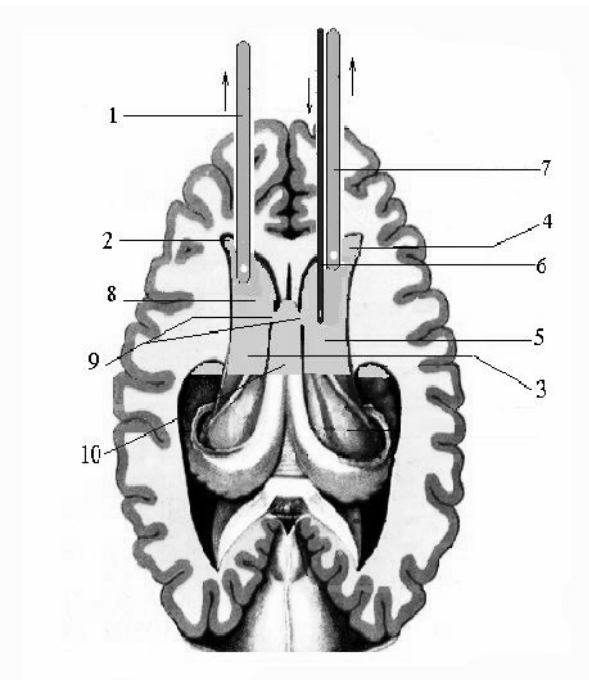


Fig. 3. Illustration of the technique: 1, 6, 7 – canullas; 2, 4 – anterior horns; 3, 5 – lateral ventricles; 8 – air cavity; 9 – foramen of Monroe; 10 – third ventricle

Discussion

Intraventricular pneumocephalus is thought to be caused by two mechanisms, both involving low intraventricular pressures bringing in air through a dural defect [2, 7, 9]. The first mechanism, as in our case, involves vertical posture during the approach to the posterior fossa, creating a pressure gradient within the CSF system. After the operation, the patient is placed in a supine position, which makes an air to fill the lateral ventricles, particularly anterior horns. The second mechanism involves a ball valve effect with air entering through a fistula, the defect then being tamponaded with brain tissue [3, 7-9]. The presence of arachnoidal adhesions then causes air to enter brain parenchyma and then the ventricular system down a gradient rather than passing to the subdural space.

In our clinical practice we observed asymmetric hydrocephalus associated with unilateral and bilateral pneumocephalus, with uneven distribution of the air in the ventricles.

In case of unilateral pneumocephalus, air breaks into foramen Monroe and by the law of surface tension forms an «air-bell», which produces a «liquid-gas» system, where air presents as volumetric incompressible structure. Formed «air-bell» blocks the outflow of CSF from the lateral ventricle leading to the formation of unilateral tension hydrocephalus. Likewise it is necessary to note that, during the operation, the ventricle system is no more hermetic. As a result, the atmospheric air, in volume proportional to the volume of the liquor that is lost, penetrates into the ventricle system. The difference of temperatures between the air in the operation room (21-23°C) and the temperature inside the cerebrum (37-38°C), increases the gaseous phase of the penetrated air according to the law of Charles and Gay-Lussac [6]. It states that at constant pressure, the volume of a given mass of a gas increases or decreases by the same factor as its temperature (in kelvins) increases or decreases.

The formula for the law is: $V/T=k$, where V is the volume, T is the temperature (measured in kelvins), k is a constant. To maintain the constant k , during heating of a gas at fixed pressure, the volume must increase. Conversely, cooling the gas decreases the volume.

According to the above law, to reduce the volume of the formed «air-bell», one should either increase the pressure of the CSF, or remove excess air from the ventricles. This raises the level of CSF to fill the foramen Monroe.

In case of bilateral pneumocephalus, with asymmetric distribution of the air in the lateral ventricles, raised intraventricular CSF pressure reduces the volume of the «air-bell». On the side with less air accumulation, the CSF rises to the level of foramen Monroe, unblocking the ventricle, and causing asymmetric hydrocephalus on the opposite side.

Conclusion

Asymmetric hydrocephalus associated with intraventricular pneumocephalus is a complex clinical problem, which can be successfully solved with the knowledge of the CSF pathophysiology and dynamics. Our results suggest that proposed technique may be a valuable option in the management of ventricular pneumocephalus.

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МИНИМАЛЬНО ИНВАЗИВНАЯ МЕТОДИКА ЛЕЧЕНИЯ НАПРЯЖЕННОЙ ВНУТРИЖЕЛУДОЧКОВОЙ ПНЕВМОЦЕФАЛИИ

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АБСТРАКТ:

Напряженная внутрижелудочковая пневмоцефалия является причиной повышения внутричерепного давления, блокирует отток спинномозговой жидкости и вызывает резкое ухудшение неврологической симптоматики, что часто требует хирургического вмешательства. В представленном клиническом примере описан новый минимально инвазивный способ лечения пневмоцефалии, осложнившейся ассиметричной гидроцефалией, в свете особенностей динамики и патофизиологии спинномозговой жидкости.

Ключевые слова:

напряженная внутрижелудочковая пневмоцефалия, гидроцефалия, ликвородинамика

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МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ И ОБОСНОВАНИЕ ПЕРЕДНЕБОКОВОЙ МИКРОДИСКЭКТОМИИ НА ГРУДНОМ ОТДЕЛЕ ПОЗВОНОЧНИКА

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АБСТРАКТ

Цель: Оценка переднебокового микрохирургического доступа к грудному отделу позвоночного канала для лечения грыж грудных межпозвонковых дисков, посредством экспериментального математического моделирования с алгоритмическим обоснованием целесообразности его выполнения.

Методы: Моделирование выполнено с учетом топографо-анатомических и биомеханических особенностей грудного отдела позвоночника, используя понятия графа, алгоритм Dijkstra и оригинальное программное обеспечение.

Результат: Создана экспериментальная математическая модель максимально безопасного и анатомически минимально травматичного хирургического доступа к грудному отделу позвоночного канала, для его вскрытия, удаления ГГМД и декомпрессии спинного мозга.

Выводы: Полученная экспериментальная модель имеет объективные недостатки, но представляет теоретическую ценность и является начальным шагом в симбиозе компьютерных и медицинских технологий, что в перспективе способно изменить методологию хирургических вмешательств.

Ключевые слова:

математическая модель, микродискэктомия, грудной отдел позвоночника, грыжа грудного межпозвонкового диска

Введение

Выполнение микрохирургической дискэктомии на грудном уровне, при грыжах грудных межпозвонковых дисков (ГГМД), представляет собой трудную задачу вследствие особенностей анатомического строения

данного отдела позвоночника. Главной задачей хирурга при этом является выполнение полноценной декомпрессии спинного мозга и обеспечение стабильности позвоночника, посредством максимально безопасного доступа, не расширяя объема вмешательства и по возможности сокращая сроки ограничения физической активности и иммобилизации.

Операцией выбора при ГГМД традиционно считается дискэктомия из переднебокового трансторакального

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