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REVIEW ARTICLE

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Bilateral ossified subdural hematoma: Literature review

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Abstract

Calcified/ossified chronic subdural hematoma is a rare clinical and radiological entity. It can occur as a rare complication of shunt surgery, or it may occur spontaneously. Computed tomography imaging is a practical diagnostic method. The clinical presentation is essential in the decision of surgical intervention. This review aimed to discuss the limited number of reported bilateral calcified/ossified chronic subdural hematoma cases in the literature, which is an even more rare condition. We reviewed 16 case reports retrieved from PubMed as presenting a similar case.

Keywords: Bilateral calcified subdural hematoma, computed tomography, treatment

Introduction

Chronic subdural hematoma (CSDH) mainly develops due to cortical, bridge vein, sinus, or cortical vessel laceration in patients with weak arachnoid trabecula following minor trauma. Most patients do not even recall the exposed trauma [1]. Its incidence increases with aging, significantly above the age of 65. With the prolongation of life expectancy in developed and developing countries, the frequency of CSDH is getting higher. Other factors in the etiology include alcoholism, liver cirrhosis, chronic renal failure, and hematological disease, besides head trauma history. The increased use of anticoagulants and antiaggregant agents in the elderly population and coronary heart diseases in the recent decades have a promotive role for CSDH [2]. Calcified chronic subdural hematoma (CCSDH) is a rare disease that constitutes approximately 0.3-2.7% of all CSDH [3]. Von Rokitansky described the first CCSDH report in an autopsy performed in 1884. The first CCSDH operation was performed by Goldhahn on an 11-year-old child in 1930 [4]. We aimed to discuss the clinical features, underlying causes, and treatment strategies of bilateral calcified subdural hematoma (BCSDH) within the literature.

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Materials and Methods

We searched the PubMed database from the beginning of the database until December 2020. The keywords used for the search were: "Calcified subdural hematoma," "Ossification of subdural hematoma," and "armored brain." Eighteen cases in the literature were identified. Two report were excluded due to failure in accessing the full text, abstract or any electronic record [5,6]. Also, we presented our case below. A total of 17 cases were summarized.

Exemplary case

A 70-year-old female patient diagnosed with bullous pemphigoid was hospitalized in the dermatology ward to initiate steroid therapy. Her medical history revealed ischemic stroke three years ago, chronic renal failure, and diabetes mellitus. In the neurological examination of the patient who did not have any neurological complaints, 4/5 motor strength (sequelae ?) was noticed in the right lower extremity. The cranial computerized tomography (CT) and magnetic resonance imaging (MRI) results were compatible with bilateral frontal ossified subdural hematoma (Figure 1). She claimed no trauma or shunt history. The neurosurgery department recommended outpatient follow-up as the patient was asymptomatic.

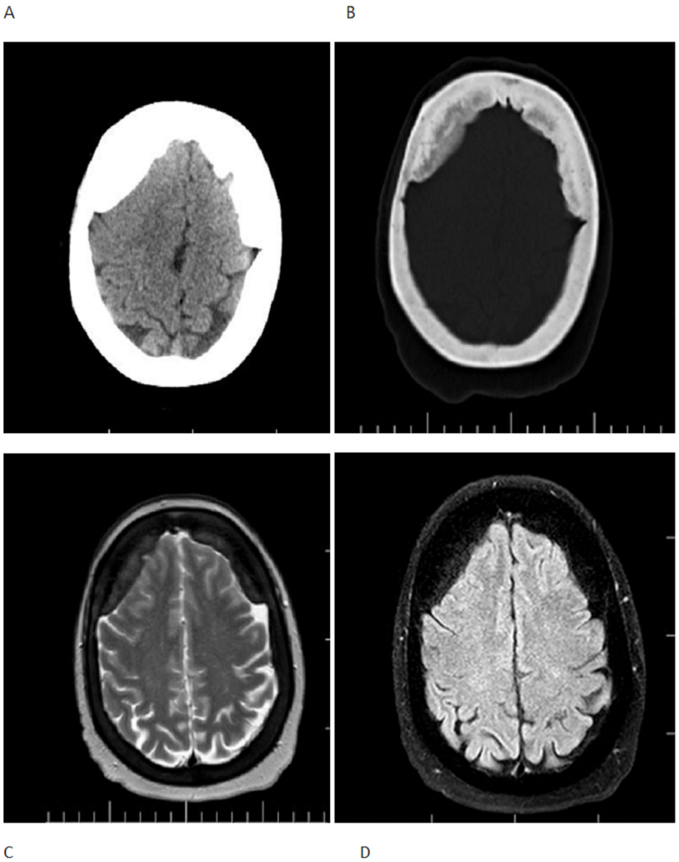

Figure 1. Computed tomography (A and B) and Magnetic rezonance image (C and D) done in showing bilateral calcified/ossified chronic subdural haematoma

Results

Age and sex distribution

The age of the patients ranged from 3 months to 86 years. In our literature review, a total of 17 cases were found, including our case. Five of the cases were female, and 12 were male. The summary of the case reports was presented in Table 1 [7-22].

Etiology

A total of 11 cases had a shunt history. Three had a ventriculoatrial (VA) shunt, and the remaining 8 had a ventriculoperitoneal (VP) shunt. Except for our case, one of the 3 cases had a history of skull fracture and subarachnoid hemorrhage due to birth trauma, another had a history of operation due to bilateral subdural hematoma, and the third case had a history of traffic accident. In patients with a history of shunt, the time to detect bleeding varies between 10 months and 40 years. In our case, there was a history of ischemic stroke 3 years ago.

Presenting symptom

The presenting symptoms include episodic headache, gait disturbance, altered level of consciousness, nausea, change of personality, painless gradual loss of vision, progressive right hemiparesis, seizure, vomiting, blurring of vision, papilledema. Some patients also have non-neurologic symptoms like abdominal pain, chills, fever, and polyuria which were related to shunt dysfunction [16].

Table 1. Cases of bilateral chronic subdural haematoma with calcified/ossified

	Author &publication year	Clinical features	Age (years)&Sex	Shunt history	Time between shunt and bilateral CSH development	History	C/S	Treatment
1	Mori N[7] et al., 1982	progressive right hemiparesis, seizure and mental physical retardation	5/M	-	-	birth injury caused by forceps delivery resulting in skull fracture and subarachnoid hemorrhage	C	craniotomy with an interval of 1 year
2	Sparado[8] et al., 1987	gait disturbance	11/M	VA	2,5 year		C	conservative
3	Al Whaibi[9]., 2003	asymptomatic	3month/M	VP (5 days after birth)	10 month		C	follow up
4	Dinç[10] et al., 2006	episodic headache	29/F			operation due to bilateral CSH 6 years ago	C	follow-up
5	Dimogerontas &Rovlias[11]; 2006	headache , vomiting, fever and deterioration of the conscious state	43/M	VA	40 year		C	follow-up (VA shunt was re-placed by VP shunt)
6	Dammers[12] et al., 2007	falls, headache, epileptic seizures, and a bilateral oculomotor paresis	67/M			meningitis at the age of 3 months, re-sulting in hydrocephalus and mental retardation	C	bilateral small craniotomy following left-sided twist drill craniostomy with controlled drainage
7	Papanikolaou[13] et al., 2008	symptoms of increased intracranial pressure	33/M	VA (2 months after birth)	33 year		C	follow up (VP shunt insertion)
8	Galldiks[14] et al., 2010	change of personality	86/M			hypertension, traffic accident 3 months ago	C	bilateral burr hole trepanation

9	Akhaddar[15] et al., 2011	episodic diffuse headache	7/M	VP	4 year		C	follow-up
10	Petraglia[16] et al., 2011	abdominal pain, nausea and chills	38/F	VP (in infancy)	38 year		C	follow-up (shunt revision)
11	Taha M[17]., 2012	seizure	12/M	VP (at birth)	12 year	1	C	Follow up
12	Salunke[18] et al., 2013	history of headache and vomiting associated with blurring of vision for three days. papilledema	15/M	VP	11 year	-		bilateral burr holes and drainage of collection.
13	Garg[19] et al., 2013	polyuria and painless progressive visual diminution	24/M	VP	4 year		C	????
14	Goyal[20]et al., 2013	headache, seizure	15/F	-	-	-	C	Bifrontal craniotomy
15	Siddiqui[21] et al., 2016	progressive visual deterioration and polyuria	30/M	VP	11 year		O	bilateral craniotomies in a single sitting.
16	Viozzi[22] et al., 2017	increased frequency of epileptic seizures, progressive drowsiness, nausea, and vomiting	15/F	VP	15 year		O	follow up (shunt revision)
17	Present study	asymptomatic	70/F			hypertension, ischemic cerebrovascular accident	O	follow up

M- Male; F- Female; CSH- Chronic subdural haematoma; VA- ventriculoatrial shunt;
VP- ventriculoperitoneal shunt;
C/O: Calcified/Ossified

Treatment

The general approach in the treatment of these patients was follow-up for hematoma. The majority of patients did not undergo any neurosurgical intervention for hematoma, while only 4 cases were received a hematoma evacuation operation. Two out of 4 who had surgery had shunts, and the other two did not. However, the patients with shunts were received specific treatments targeting shunt dysfunction. Our completely asymptomatic case needed no neurosurgical intervention.

Discussion

Calcified CSDH (CCSDH) is an infrequent radiologic picture. It also appears as a long-term complication in patients who underwent ventricular shunt therapy for hydrocephalus [11,23,24]. The possible mechanism was based on the overdrainage of cerebrospinal fluid by ventricular shunt, reduced intracranial pressure, partial collapse of the brain, stretching of bridging veins due to widening of the subdural space and finally hemorrhage formation [15]. Some authors pointed at brain atrophy, microcirculation disorder, meningitis, encephalitis, and premature delivery as well [26]. The pathogenesis of calcified CSDH is not revealed clearly but the hemorrhage itself may be major contributor as progression from hyalinization to calcification [26,28]. Vascular factors like poor circulation and absorption in the subdural space and also thrombosis have been suggested as the underlying mechanism of calcification in recent years [25]. Other possible explanations for calcification in CSDH include active vascular proliferation in damaged brain tissue and metabolic factors [8,27]. The hematoma formation-calcification time interval is reported as a few years but can vary from 6 months to many years [29-31].

Bilateral calcified chronic subdural hematoma = Armored brain

Bilateral occurrence of CSDH is rarer, classically named "armored brain," due to the classic CT appearance, results from extensive linear calcification lines [11]. The lines can extent in both the parietal and visceral capsules, or through the hematoma itself [15]. Physicians should be aware that the terms "calcified" and "ossified" are not the alternative for another. Ossification presents for the organized CSDH after hyalinization and calcification steps, respectively. Therefore, evidence of bone formation is expected in case of ossification. The literature offers only 2 cases with bilateral ossified subdural hematoma, which our case presents the third [21,22].

The presenting symptoms of CCSDH can vary in each case but headache is the most common. As the majority of cases are asymptomatic, they can suffer from the reflections of severe acute intracranial pressure as well [15,28,33]. The clinical signs of CCSDH are not very different form non-calcified CSDH and include headache, weakness, numbness, gait disturbance, dysphasia, seizures, memory impairment and altered level of consciousness [6,32]. The pictorial appearance on CT and MRI studies provides the radiological diagnosis but in some cases, the exclusion of other calcified extra-axial lesions (calcified epidural hematoma, subdural empyema, meningioma, calcified arachnoid cyst, calcified convexity dura mater with acute epidural hematoma, and malignant tumors) cannot be easy performed. Therefore, pathological examination is essential for confirming the diagnosis [6]. The general approach is surgery for infants/young patients or patients with neurological symptoms, and non-surgical follow-up for asymptomatic patients with CCSDH which is still controversial [28,34-36]. Some authors advocated the unnecessity of surgery in elder population [33]. On the other hand, some justified surgery for relieving compression even in asymptomatic cases to prevent future brain damage [28]. Considering surgery in symptomatic cases as a result of mass effect of the lesion may be beneficial due to potential expanding pattern in some CCSDH examples. It is also a fact that the symptoms can improve after surgery [34]. But the occurrence of surgery-related complications is always on the table. For example, Moon et al. reported a case with acute subdural hematoma on the contralateral side after removal of CCSDH and suggested that perioperative parenchymal shifting proceeded by tethering venous structure damage as possible mechanism [36]. The regarding complication with same characteristics was described in a 16-year-old boy by Tatlı et al [37].

Other causes of the severe cerebral edema after surgery in the case could include NPPB (normal perfusion pressure breakthrough), seizure, and electrolyte disorder. NPPB is likely due to pressure autoregulation dysfunctionality of the vasculature on CCSDH side. The surgical removal of CCSDH may end up with tissue swelling or bleeding via NPPB theory [38,39]. Another report described a case who underwent surgery for CCSDH and developed bilateral tension pneumocephalus on the 3rd day following craniotomy. Their patient exhibited subsequent right-sided weakness on the upper extremity which showed complete recovery after frontal burr-hole intervention [40].

Conclusion

Although CSH is a common pathology in neurology and neurosurgery practices, calcified/ossified subdural hematoma is rare. In addition, BCCSDH is limited with 17 patients in the literature, including our case. The vast majority of them have a shunt history, and they show shunt dysfunction-related symptoms. Shunt dysfunction treatment constitutes the majority of the treatment.

Conflict of interests
The authors declare that they have no competing interests.

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Looking at offloading in diabetic foot from a different angle- the triangle

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Abstract

Plantar ulcerations are quite common in foot of diabetic patient and majority of them are neuropathic. In view of these ulcers being located at weight bearing areas, it becomes essential to reduce pressure on wounds to facilitate optimal healing. In spite of knowing the benefits of offloading and also availability of various methods and devices, the practice of offloading has been suboptimal in many regions. This article aims to discuss some of the available offloading methods through a new teaching model, the triangle of offloading.

Keywords: Diabetes, foot, ulcer, triangle, offloading

Introduction

Diabetes mellitus is a chronic non communicable disease which is a major public health problem of 21st century [1]. It is predicted that there will be 552 million people with diabetes globally by the year 2030 [2]. India is also showing a drastic increase in diabetes and it is estimated that by 2030, there will be 79.4 million people suffering from diabetes [1, 3]. Even the burden of diabetes related complications is very high in India [4].

A common distressing complication of diabetes is the diabetic foot. It is estimated that globally, there are around 20 million people who have diabetic foot and around 2 million of them require amputation every year [5].

Diabetic foot ulcers, which is characterized by triad of neuropathy, infection and ischemia, continues to be a major health care burden [6, 7].The lifetime risk of developing a diabetic foot ulcer range from 15-25% [8, 6, 9]. It is stated that every year 5 % of diabetes patient develop foot ulcers and 1% will require some amputations [10]. Foot ulcers may affect both feet and bilateral involvement ranges from 7.4% to 11.1% [8].

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Many factors are involved in causation of diabetic foot ulcers apart from neuropathy and peripheral vascular disease. Some of the notable factors include trauma, previous ulcers, deformities, improper footwear, etc [11].

Most of the diabetic foot ulcers are located commonly over weight bearing area of the foot [12]. Most diabetic foot ulcers are located in forefoot region. In Smith et al study, the ulcers occurred in forefoot is 79% of cases whereas in Jain et al series, 88.8% of diabetic foot ulcers occurred in forefoot [8, 13].

Now with diabetic foot ulcers being on weight bearing areas commonly, they are subjected to frequent trauma that will not allow the ulcer to heal [12, 14]. Hence, in management of plantar ulcers, the pressure has to be redistributed away from the ulcer and this is known as offloading [14, 15].

It is stated that an ideal properties of pressure relieving methods consist of provision of effective pressure reduction throughout, cost effective in nature, should be easily applied with no side effects and patient should be compliant [16]. There are numerous offloading methods for healing diabetic foot ulcers and we shall address them through the new triangle of offloading [17].

Triangle of offloading

The Amit Jain's triangle of offloading (Figure 1) is a new teaching model that was proposed, in lines similar to triangle of wound assessment that provided a framework in wound management [18].

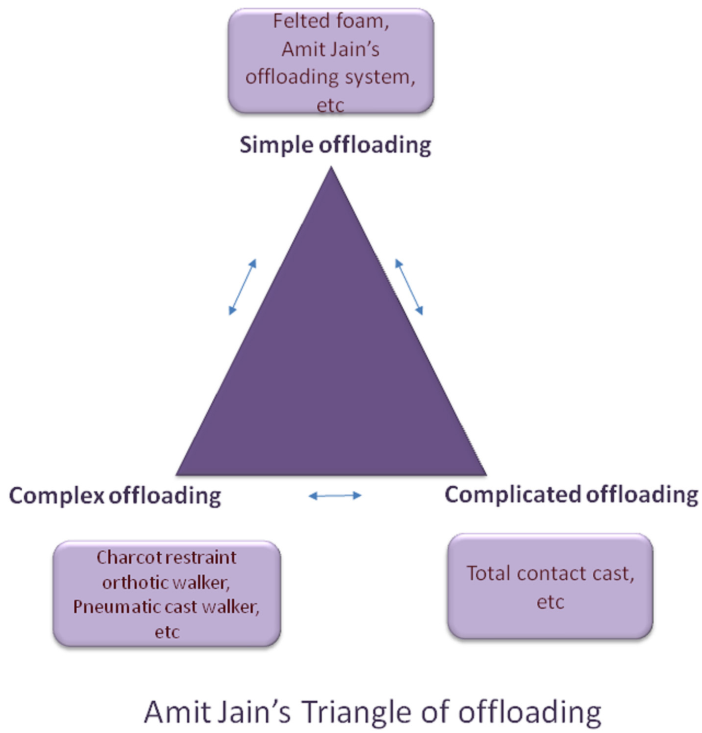

Figure 1. Amit Jain's triangle of offloading for diabetic foot

This triangle of offloading was obtained from Amit Jain's 'SCC' classification for offloading that categorized the offloading into 3 types namely type 1 offloading (simple), type 2 offloading (complex) and type 3 offloading (complicated) [19].

The 3 corner areas of the triangle of offloading represents the various offloading options available that can be used for diabetic foot ulcer [18].

Type 1 offloading - simple offloadings

Simple offloading is easiest to use and apply in diabetic foot ulcers [19]. Some of the offloading in this category includes the felted foam, wedged footwear's, Amit Jain's offloading system, etc. [19]. The felted foam has been used successfully by many clinicians who are trained in this technique [20]. A study by Raspovic et al showed that felted padding was the most commonly chosen modality for offloading the plantar ulcers and was used by 94% of the clinicians [14]. A study showed that 93% of ulcers healed within 12 weeks when they were treated by felted foam compared to 92% in people treated with total contact cast [20]. There are many advantage of felted foam like it can be used in presence of infection, wounds can be observed frequently, patient's can walk and go to work and further it is not as expensive as TCC [21].

However, the recent IWGDF guidelines state that it should not be used unless other options are not available as it is considered by the guidelines to be the least effective offloading device [21]. However many clinicians consider it to be first choice in their practice and have noticed good healing in their patients [20, 21, 14].

The another simple offloading that works on deflective offloading concept is the Amit Jain's offloading system, which is considered to be a better alternative to felted foam and can be used in places where felted foam is not available and TCC is not preferred [23]. In this offloading system, two distinct types are available. In standard offloading system, a combination of microcellular rubber and ethyl vinyl acetate is used, whereas in variant type, only ethyl vinyl acetate or other visco-elastic material is used similar in pattern of felted foams [24]. A recent study found that 94% of the ulcers healed at the end of 8 weeks with Amit Jain's offloading system with no difference between standard and variant type of offloading [25].

Another simple type of offloading is the Samadhan system [26]. In this offloading method, a foam is rolled in cylindrical shape after applying adhesive to it and this is placed proximal to the forefoot ulcer and a retainer bandage is applied [26]. Patient can use this in footwear and do his work [27]. There are few case reports [26, 27] published on this technique by its innovator. Various other materials have been used by others like roller gauge, rolled up pads, gloves, etc instead of rolled foam though none have demonstrated any benefit over it [23].

Wedge shoes, half shoes, peg insoles, etc are other type of simple offloading used in clinical practice [19]. In peg insole footwear, plugs of materials are removed at area to be offloaded [12]. A study on ortho-wedge shoes showed 64-66% reduction in pressure [28]. The practical issue with anterior or posterior ortho- wedge footwear is instability during walking and risk of fall especially in elderly. In the wedged footwear, there is a thick wedged shaped section in the sole that has a thin platform part at the area to be offloaded [29]. The purpose of wedged footwear is to reduce the mechanical pressure on the wound so that there is healing. It was recommended as an alternative in ulcer management where other devices like TCC or RCW cannot be used [30]. However, the wedge footwear cannot or should not be used if patient has ankle equinus or bilateral ulcers [31].

Type 2 offloading- complex offloadings

Removable walker like pneumatic walker or Charcot restraint orthotic walker (CROW) are commonly used offloading devices that were designed to be alternatives to the total contact cast [12, 28]. These removable cast walkers are complex offloading device [18, 19] and they can be considered superior to many other offloading devices [20]. A study by Wu et al showed that only 15.2% used removal cast walkers [32]. The pneumatic walker, also known as aircast, offloads the foot by achieving complete contact with plantar aspect of foot [12]. These devices are equally efficacious like TCC and have a distinct advantage of removing, inspecting the wound and dressing it [15]. They can be used in presence of ischemia unlike TCC [15].

Another complex offloading device is Charcot restraint orthotic walker, which can be used in second and third stages of Charcot foot to maintain joint stability [28]. This bivalve ankle foot orthosis lasts for longer period [12].

Type 3 offloading- complicated offloadings

These offloading require time to apply and also expertise [19]. The examples of complicated offloadings are total contact cast (Figure 2) and Bohler Iron plantar cast [18, 19]. Total contact cast is considered to be the most effective offloading method for diabetic foot wounds as it redistributes the pressure across the foot efficiently [16]. Although considered gold standard by many, a study by Wu et al showed that majority (58%) do not consider TCC as gold standard and less than 2% used TCC [12, 32]. TCC heals wound in short period of time and many studies showed healing rates to be as high as 90% by end of 12 weeks [20, 33]. In spite of TCC being an excellent offloading method, there are numerous disadvantages associated with it like time consuming, requires expertise, costly, cannot be used in infected wounds and ischemia, etc [12, 20, 23]. Further, TCC is not frequently used at many places due to lack of training and resources [29]. The complications with TCC are also high and have been under-reported.

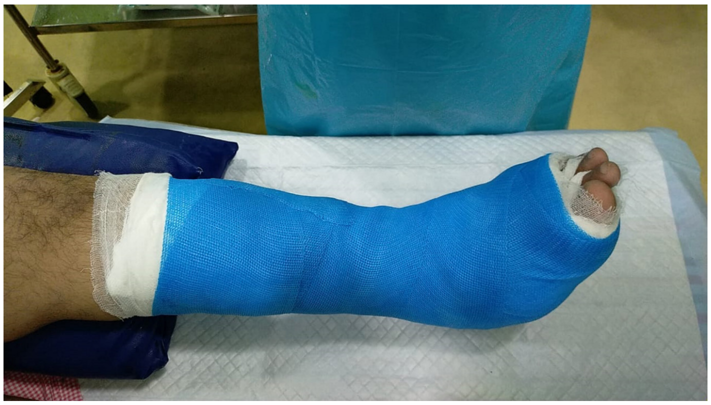

Figure 2. Total contact cast being applied. This is type 3 offloading

Bohler Iron plantar cast is another complicated offloading device that is effective in healing [34]. It is also time consuming and is not easily available at many places and requires training. A study by Saikia et al found Bohler iron cast to have a good healing of ulcers without affecting the lower extremity function [34].

Conclusion

Distinct methods of offloading are available in different parts of the world and a clinician can choose which ever is best suitable for his patient provided it is effective. The offloading modalities range from simple off loadings like felted foam to complicated offloading like total contact cast, which is expensive and requires expertise. Each offloading method has its own advantage and disadvantage and it requires a good decision making as to which is appropriate to his patient based on clinical evaluation. Cost evaluation and patient's job profile are also essential key factors in deciding the choice of offloading in clinical practice apart from other local wound factors.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

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LETTER TO THE EDITOR

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Anesthetic management for cesarean delivery in a COVID-19-infected pregnant woman with renal transplant

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Dear editor,

Clinical features reported in pregnant women infected with COVID-19 are similar to those of adults infected with COVID-19 in the general population. Despite this, physiological changes in the immune system and cardiopulmonary system may make pregnant women more susceptible to respiratory pathogens. In addition to pregnancy, chronic diseases of the pregnant woman, transplantation and immunosuppressive treatments increase the risk of infection 1.

Nowadays, with the increase in the number of renal transplants and the developments in immunosuppressive treatments after transplantation, the mortalityand morbidity rates have decreased and there has been a dramatic increase in the number of women of reproductive age who undergo renaltransplantation 2. In this article, we wanted to share our experience of anesthesia management in the cesarean delivery of a pregnant with covid-infected renal transplant.

A thirty-years-old, 57 kilogram, 157 centimeter, 36-week pregnant woman was preoperatively evaluated upon the decision to terminate the pregnancy. It was learned that the she had a renal transplant about 12 years ago and was follow up with hypertension. In the physical examination of the pregnant woman, there were cough and shortness of breath aggravated by exertion. Common coarseness in lung sounds in both hemithorax, ral was heard on the right side. In preoperative laboratory examinations, RT-PCR test was positive. She anemia consistent with iron deficiency (Hgb: 8.9 g/dL). Coagulationprofile was normal. Serum urea (52.3 mg/dL) and creatinine (1.49 mg/dL) were high, electrolytes were within normal limits. She was using tacrolimus 1 mg/day, methylprednisolone 5mg/day and nifedipine 30mg/day as treatment.

Informed consent was obtained for the procedure.After providing the necessary physical environment and protection for COVID-19, the patient was brought to operating room. Firstmonitoring values were recorded as heart rate: 95 beat/ min, blood pressure: 125/89 mmHg and SpO_2: 94%. Spinal anesthesia was applied with 10 mg hyperbaric bupivacaine. Surgery was started after it was determined that the sensory block reached the T6 dermatome. At the 6th minute of the surgery, 2730 grams of male baby was delivered. The baby's APGAR scores was 6/8. The first peripheral oxygen saturation was 67%. He was taken to the neonatal intensive care unit due to respiratory distress. 100 ml urine output and approximately 500 ml of surgical bleeding were observed. When the surgery was completed, the spinal anesthesia level was determined to be at the level of T10 dermatome, and the patient was sent to the room with postoperative recommendations.

In the postoperative period, the lung was visualized by x-ray and tomography. Widespread patchy involvement was seen in both lungs (Figure 1). For COVID-19 infection, favipravir, hydroxychloroquine and enoxaparin triple treatment protocol was planned. On the postoperative 1st day, an increase in serum potassium value (6.1 mmol / L) was determined compared to the basal potassium value (4.7 mmol / L). No clinical findings were observed due to high potassium. During following day, potassium level decreased and reached normal values without intervention. RT-PCR test of the baby was negative. After the day, the baby's respiratory distress regressed and he was given to the mother. On the 13th day of his treatment, the patient was discharged (Table 1).

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Table 1. During the treatment,some laboratory test results of the patient

	Preoperative	Postoperative 1st day	Postoperative 3th day	Postoperative 5th day	Postoperative 7th day	Postoperative 9th day	Postoperative 11th day
White Blood Cell (cells/mm³)	12450	22880	21000	10970	9820	8830	9830
Neutrophil (cells/mm³)	7670	17970	17400	8120	6690	5600	5380
Lymphocyte (cells/mm³)	4530	1930	3180	2370	2540	2540	3340
C-Reactive Protein (mg/L)	112	108	176	55	71	70	35
Sedimentation (mg/h)	105	*	140	109	72	11	19
D-Dimer (ng/mL)	957	*	493	476	489	480	421
Fibrinogen (mg/dL)	521	*	592	547	592	577	427
Ferritin (µg/L)	1733	*	1945	1917	1711	1301	989

Figure 1. Postoperative, before the medical treatment for COVID-19 chest x-ray and some sections from the tomography

In conclusion, with the social spread of Covid-19, rare cases are encountered and interactions with different diseases are experienced. In this renal transplant covid-infected case, we provided a successful anesthesia management and delivered by cesarean section. We believe that these cases can be managed smoothly with the choice of spinal anesthesia in appropriate surgeries.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

All authors declare no financial support.

Patient Informed Consent

Consent form is abtained.

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