

## Case Report: Pregnancy in a Tetraplegic Female

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Received Date: January 02, 2020 Accepted Date: January 20, 2020 Published Date: January 22, 2020

Citation: Nelson Rabbachin (2020) Case Report: Pregnancy in a Tetraplegic Female. J Womens Health Gyn 7: 1-6.

### Abstract

**Background:** The worldwide incidence of spinal cord injury is around 40 to 80 cases/million. Spinal cord lesions have motor, sensory and autonomous consequences. On average, patients with spinal cord injuries are still in their reproductive years, and around 20 percent are female. Increased survival and modern reproductive technology enable these patients to achieve pregnancy despite their medical condition. Pregnancy in this population presents unique obstetrical, urological and neurological challenges for which a multidisciplinary approach is necessary.

**Case:** A 36-year-old female, gravida 3, para 0 was referred to our tertiary centre for obstetrics and prenatal medicine following IVF-ICSI conception. Our patient was known to have a spinal cord lesion level C6-C7 resulting in tetraplegia for 17 years. A multidisciplinary approach with obstetricians, urologists, anesthesiologists, and rehabilitation doctors were used to approach the possible difficulties and particularities of pregnancy in tetraplegic patients.

**Conclusion:** We achieved a successful obstetrical follow-up, birth and postpartum period for a patient with a known spinal cord lesion. Our patient gave birth to a healthy child via Caesarean section at 38 weeks of gestation. The key to this success was the multidisciplinary approach. No serious complications, such as autonomic hyperreflexia, have been encountered during her hospital stay. The postpartum period developed well and permitted breastfeeding.

**Keywords:** Pregnancy; spinal cord injury; spinal cord lesion; breastfeeding; autonomic hyperreflexia

## Introduction

Globally, the incidence of spinal cord injury is around 40-80 cases/million [1]. Around 11,000 new cases of spinal cord lesions are reported in the United States yearly. The most common causes of spinal cord lesions are motor vehicle and driving accidents, gunshot wounds, traumatic falls, spinal cord hematomas, multiple sclerosis, and transverse myelitis. Spinal cord lesions have motor, sensory and autonomous consequences [2]. In 2010, the average age of spinal cord injury victims was 37 years old; more than 50 percent of spinal cord injuries happen to persons during their reproductive years. Females make up 20-23 percent of cases [3]. Increased survival and modern reproductive technology enable these patients to achieve pregnancy despite their medical condition. Fourteen percent will achieve pregnancy at least once [4,5]. Pregnancy in this population presents unique obstetrical, urological and neurological challenges for which a multidisciplinary approach is necessary.

## Case Presentation

We describe the case of a 36-year-old pregnant female, gravida 3 para 0, with a known spinal cord lesion, referred to our tertiary obstetrics center, UZ Brussel, after IVF-ICSI conception. She conceived in this way because she was a single mother. She suffered from a spinal cord lesion at seventeen years, which consisted of tetraplegia at the C6-C7 level. The International Standards for Neurological Classification of Spinal Cord Injury worksheet filled out by her rehabilitation doctor concludes that the patient has an incomplete spinal cord injury with a left and right sensory and motor C7 level with a neurological level of injury at C7 and an AIS/A Impairment Scale grade B. Certain visceral and cutaneous stimuli can still be felt.

In order to provide adequate healthcare for our patients, we established a multi-disciplinary follow-up. She was seen by a senior staff member on a regular basis during her pregnancy and management was in conjunction with her rehabilitation doctor and urologist.

Up until the 30th week of pregnancy, she was seen every four weeks for a routine obstetric consultation. Blood pressure and urine (proteins and glucose) were checked every time. Routine ultrasound first assessments were done at 12w2d and 20w4d. Normal fetal development was noted, although the second ultrasound found a unilateral notch in the left uterine artery. This unilateral notch disappeared at 26w3d. The non-invasive prenatal test (NIPT) indicates a normal 46 XX karyotype. At 26 weeks a positive oral glucose tolerance test was found and appropriate

glucose control of her gestational diabetes was achieved with a diet. A cyclic weekly scheme of fosfomycin 3g (Monuril<sup>®</sup>) and nitrofurantoin 200mg (Furadantine<sup>®</sup>) three times a day was used as prophylaxis against urinary tract infections.

From 32 weeks, a weekly follow-up at the obstetric day clinic with a senior staff member was implemented. Again, both blood pressure and urine were examined, alongside routine CTG fetal monitoring. Her ultrasound at 32 weeks showed a fetus in vertex presentation with an estimated weight of 1670g (p25-50). From 34 weeks, daily thromboprophylaxis was initiated with nadroparin SC (Fraxiparine<sup>®</sup>). Anesthesia options were discussed with the anesthesiologist at 34 weeks. A pulmonary evaluation was performed. The chest radiography showed normal pulmonary ventilation. No other abnormalities were seen. Pulmonary function analysis revealed a slightly lower peak flow and Krogh-factor. This is often seen in persons with cervical spinal cord lesions and is due to her muscle weakness. A final check-up with her rehabilitation doctor was planned at 36 weeks. The details of her lesion were verified and reaffirmed. At the same time, an appointment with the ergo therapist and midwife was planned in order to give appropriate information concerning mobilization, prevention of pressure ulcers and specificities in the postpartum period. Possible adaptations to her home environment were discussed.

Vaginal birth would not be contra-indicated in case of spontaneous advanced labor; however, hospitalization at 38 weeks of pregnancy was planned to prevent this. In conjunction with the anesthesiologist and other medical professionals, an elective cesarean was planned at 38w1d, taking into account her age, the IVF procedure, her medical condition, and maternal choice. In case of spontaneous labor or spontaneous rupture of membranes, hospital admission with the same policy was planned. Vaginal birth was not contraindicated in case of advanced labor at the time of admission.

A cesarean section was performed using a Pfannenstiel incision with epidural anesthesia (L4-L5), at 38w3d with a fast extraction to lower the risk of acute autonomous hyperreflexia. During this intervention, blood pressure remained <140mmHg systolic and <110 diastolic while in the operation theatre. No symptoms of autonomic hyperreflexia were noted. Estimated blood losses were physiologic with pre-operative hemoglobin 10.1 g/dL and post-operative 10.0 g/dL. The female neonate had an APGAR-score of 10-10-10 and a weighted 2800g. Our patient was sent to the recovery ward for two-three hours for observation (normally, this would be only one hour) but did not devel-

op any autonomous hyperreflexia. She has been able to return to the maternity ward with her child and has decided to start breastfeeding. A thorough follow-up of blood pressure and glycemia was foreseen. Analgesia was provided with epidural anesthesia for at least 48 hours, followed by our standard scheme of paracetamol 1g (Dafalgan ®) four times daily in combination with diclofenac 75mg (Voltaren ®) three times daily. Thromboprophylaxis was started with enoxaparin (Clexane ®) daily for up to six weeks postpartum. An indwelling catheter was provided for eight days. Physiotherapy with passive mobilization was started at day one, and an anti-decubitus mattress was used. Her postoperative hemoglobin was 10g/dl. When the epidural anesthesia was stopped, higher blood pressures were noticed, rising to 130/100 mmHg; this was thought to be because of lowered efficiency with the PO analgesia. A vesical residue of 300cc was noticed after retrieving the indwelling bladder catheter on day ten. According to the urology department, this was acceptable. A follow-up for her vesical residue was planned. Since our patient lived next to the hospital, she would return to us several times after spontaneous miction to measure the residue.

Both our patient and her new-born child left the hospital in good condition after ten days. Due to her tetraplegia and because she was a single mother, she had to organize her home and care for her new-born. To do this, she counts on her close family, which also supported her during her pregnancy. As with all discharged mothers from the maternity ward after giving birth, regular midwife visits at home were planned to help during the first weeks of maternity. In this way, a medical follow up was achieved in the immediate postpartum period at home. Breast-feeding was successful during her stay in the hospital and was still present until eight weeks postpartum.

## Discussion

### Obstetrical

Fertility is usually maintained after a period of amenorrhea in the acute phase of a spinal cord lesion. Knowledge about obstetric management of women with spinal cord lesions is not widespread and remains limited [6]. People with spinal cord injury do not have a higher risk for either congenital malformations or intrauterine fetal death [1]. However, preterm labor is not uncommon in patients with spinal cord lesions above T10, since they are unable to feel uterine contractions in the usual way [2]. About eleven to thirteen percent will give birth before 37w of gestation. [6] Patients should learn auto-palpation to feel possible contractions [4,7]. Vaginal birth can be achieved in women with spinal lesions. Cesarean sections are mostly done due

to obstetric indications unrelated to the spinal lesion. Regional anesthesia can be achieved through both spinal and epidural means. However, epidural anesthesia is not possible in cases of syringomyelia or when epidural catheter introduction could be unpredictable. [6, 7] In this population, Caesarean sections are more frequent, with an incidence of 29 to 43 percent [5]. In our case, we reviewed both vaginal as well as Caesarean birth in conjunction with our patient. After careful deliberation, we opted for a Caesarean section though there was not a clear medical or obstetrical reason.

### Anesthesia

All patients with a spinal cord lesion above T6 are at increased risk for presenting acute autonomic hyperreflexia (AHR). Symptoms mostly occur during parturition but can occur at any given time during pregnancy [8]. An early and adequate labor analgesia may be able to prevent or improve peripartum complications [2]. AHR can be seen as a return of spinal reflexes. A loss of control of sympathetic spinal reflexes occurs in viable spinal cord segments distal to the spinal lesion [4]. Stimuli such as manipulation or distention of the bladder, vagina, bowels or urethra can be possible triggers [4]. In an obstetrical setting, uterine contractions can also incite AHR [2, 4]. The most common manifestations are vasoconstriction and severe hypertension below the lesion. Patients may experience sweating, headache, facial flushing, nasal congestion, tinnitus, and anxiety. Cardiac dysrhythmias, as well as reactive bradycardia and sinus tachycardia, may also be present [2]. Vasoconstriction in the uteroplacental vessels may result in fetal hypoxemia [4]. Possible severe complications include hypertensive encephalopathy, cardiovascular accidents, intraventricular and retinal hemorrhages, and even death [4]. Invasive arterial monitoring could be considered [5, 6]. The risk of developing AHR remains elevated even in the postpartum period due to postsurgical nociceptive input, bladder distention or uterine contractions [5, 6]. Patients with higher lesions can also be prone to AHR due to lactation [5]. AHR can be an indication for Caesarean section when blood pressure cannot be controlled [5]. Obstetricians frequently mistake these conditions for preeclampsia. Liver and renal function tests can make a distinction between these separate entities [1, 2]. Treatment consists of prompt administration of labor analgesia. Since spinal-epidural analgesia has a rapid onset, this can be suitable for these patients [2]. Ideally, labor anesthesia should achieve a sensory block above T10. This can be achieved with a combination of a local anesthetic and an opioid. Epidural anesthesia is preferred for a vaginal delivery, whilst spinal anesthesia is preferred for a Caesarean delivery [2]. In cases of hypertension

before or despite regional anesthesia, antihypertensive agents with a rapid yet short duration of action can be applied [4].

To achieve adequate anesthesia during the cesarean section we opted for epidural anesthesia. The literature supports this decision for the Caesarean section, as it also decreases the risk of acute autonomous hyperreflexia. [2]. All efforts have been dedicated to avoiding this complication. A planned Caesarean section minimizes risks, and all pharmacological interventions were discussed by the multidisciplinary staff.

In the case of a post-partum AHR onset, we would have used sublingual nifedipine or clonidine and labetalol IV, based on the literature [6]. The use of clonidine is not considered safe during pregnancy, although no adverse effects have been reported at this time. Glyceryl trinitrate can be used in non-pregnant subjects [6]. Another case series, conducted by Sharpe, had similar results with IV and PO labetalol and also showed beneficial results with IV hydralazine [5]. One case report by Maehama stated that IV magnesium sulfate was already enough to suppress AHR [9]. All of the literature has agreed that adequate vital function monitoring is essential during parturition, and postpartum, to prevent and provide early diagnosis of acute autonomous hyperreflexia. Both we and Sharpe proposed epidural anesthesia in the postpartum period [5]. Mindfulness about possible triggers such as postsurgical pain, bladder distention or uterine contraction is warranted [5].

## **Urological**

Asymptomatic bacteriuria is present in the majority of cases. Due to ineffective bladder emptying leading to stasis and infection, neurogenic bladder and (intermittent) indwelling catheters, infections and renal failure may occur [2, 4]. The incidence of urinary tract infections rises from eight to 45.5 percent due to pregnancy and can be a risk factor for preterm labor [10, 11]. Routine urine analysis and antibiotic prophylaxis are indicated [4]. A weekly oral cyclic antibiotic regimen and elevation of hydration and self-catheterization are proposed as a prophylaxis for urinary tract infections. A significant reduction of urinary tract infections was observed with this regimen [10,11]. Currently, the emergence of multidrug-resistant organisms has not been noted with the use of antibioprophyllaxy. [12]. Some anticholinergics can be continued during pregnancy. The use of intradetrusor botulin injections is not advised [11].

We have added prophylaxis for urinary tract infections with a cyclic antibiotic regimen consisting of fosfomycin C and nitrofurantoin. Both were alternated weekly. Other regimens

have been proposed: amoxicillin 3000mg, cefixime 400mg, and nitrofurantoin 300mg [10,11]. No random controlled trial exists confirming the most effective combination for this prophylaxis but all of the literature agrees that the implementation of antimicrobial prophylaxis in pregnant women with spinal cord lesions is effective in significantly reducing the incidence of urinary tract infections [4, 10, 11]. We have performed urine culture at random during the patient's pregnancy with negative results.

The patient has successfully used "tapotage" to empty her bladder for years and continued to do so during her pregnancy. Mostly, we see that patients have to manage their bladder retention with intermittent bladder catheterization. This method can be continued during pregnancy. However, in most cases, we see a significant rise in catheterization frequency [11]. Although "tapotage" is not the preferred option for bladder emptying, she preferred this option and, in this case, the method was sufficient. After taking out the bladder catheter post-cesarean, she continued to have a small residue of 300cc. The urology department considered this acceptable as long as there would be a follow-up. During the postpartum period, she would come to the hospital post-miction at home for a bladder scan. Since we persistently found residues between 200-400cc, we proposed to restart intermittent catheterization between two and five times daily. This could be done only with help from her relatives. Alternatively, a Mitrofanoff appendicectomy was discussed. After two months, the residues were still around 140cc. In conjunction with the patient, conservative management with "tapotage" and intermittent catheterization as needed was decided upon.

## **Skin**

Decubital ulcers are a frequent yet preventable condition in women with spinal cord lesions. Thoughtful skin examination, adapted wheelchairs and mattresses are indicated. Weight gain and edema are also important contributors to decubital ulcers [4]. The patient developed two small skin ulcers of 0.2cm in diameter during the post-partum period on her back at the pressure point of the epidural catheter, but these were rapidly resolved through local care.

## **Pulmonary**

Women with cervical or thoracic lesions may present with impaired pulmonary function. In the case of a borderline function of ventilator-assisted ventilation, attention to pulmonary care during pregnancy and parturition appears to be indicated. Prepartal serial assessment of pulmonary vital capacity is necessary [4]. Our patient showed a normal long volume in her

chest radiography. The functional respiratory tests showed the functional vital capacity of 3, 24L. Slightly lower peak flow was seen. This could be attributed to the muscle weakness intrinsic to her spinal lesion.

### **Gestational diabetes**

We screen routinely for gestational diabetes in pregnancy around 24 weeks. We found a positive oral glucose tolerance test at 26 weeks. Appropriate glucose control was achieved through diet. Studies have shown an association between spinal cord injuries and diabetes. This could be attributed to the physical disability, but also to additional autonomic and metabolic changes due to loss of descending spinal control. Another proposed mechanism is the association between sarcopenia due to spinal cord injury and reduced mobility and insulin sensitivity [13]. Following this last hypothesis, we can only assume that this effect is even further pronounced due to the pregnancy, itself. No studies concerning this claim exist at this time. One study has stated that raised CRP levels due to neurogenic lower urinary tract dysfunction cause a permanent inflammatory status. This inflammation may be associated with the development of further insulin resistance and type 2 diabetes [14]. The prevalence of diabetes type 2 is also higher in people with spinal cord lesions compared to people without (13.66% vs. 5.91%) [13, 14]. An OR of 1.66 (95% CI 1.16-3.52) for the development of diabetes type 2 is noted after adjustment for sex and age [13]. As our patient was more than 35 years old, her risk for developing (gestational) diabetes was also increased.

### **Breastfeeding**

During her pregnancy, our patient revealed that she was interested in breastfeeding her newborn. Spinal cord lesions, as from T1, will cause impaired milk production, leading to impaired or absent ability to breastfeed. This can be attributed to a lack of sympathetic innervation. Some studies refute this, however, by showing the capacity to breastfeed for many months [15]. Hypogalactia could be a consequence of the impaired sensory-afferent component of the milk ejection reflex. Education on how to elicit this reflex can solve this problem [15]. Caution should be taken, however, as breastfeeding could elicit AHR in rare cases. In such cases, the AHR should be treated as noted above and breastfeeding should be stopped [16]. Our patient started breastfeeding immediately postpartum. She was helped by the midwife team during her time in the hospital and by her mother at home. At her postpartum checkup, eight weeks later, she was still breastfeeding.

## **Conclusion**

As noted above, spinal cord lesions in pregnant women present a variety of specific challenges. An adequate and multidisciplinary approach is essential for optimal patient care. Knowledge about these unique complications remains limited among obstetricians. Boisseau showed that at least 84,8% of obstetricians declare that they have had difficulties achieving an adequate follow up for these women. Only 37% were familiar with the concept of acute autonomous hyperreflexia [7]. As stated in the literature, an early anesthesia consultation and providing the patient information about labor are proven to be useful [4].

Patients with a history of spinal cord lesions experience chronic effects of their condition. Different organ systems will be affected and demand special attention during pregnancy. Chronic effects include impaired pulmonary function, cardiovascular impairment such as autonomic hyperreflexia, chronic pulmonary and urinary infections, anemia, decubital ulcers and alterations in thermoregulation [2, 4].

We achieved a successful obstetrical follow-up, birth and postpartum period in a patient with a known spinal cord lesion. The key to this success was the multidisciplinary approach. Input from the obstetricians, urologists, rehabilitation team and anesthesiologist is essential in unique cases such as these. A clear management plan for prevention and treatment for both obstetrical and other complications such as autonomous hyperreflexia and urine tract infections was used.

## **Disclosure statements**

The authors declare that there is no specific interest that could influence the impartiality of the research reported. The patient was aware of the fact that we were writing a case report and gave her consent.

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