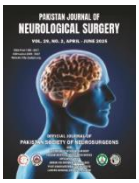

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Original Research

Spinal Cord Injury and Pregnancy: Obstetric Challenges and Neonatal Outcomes

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ABSTRACT

Objective: Pregnant women with spinal cord injury (SCI) can have severe obstetric and neonatal challenges. However, there is limited literature on this population. Therefore, the objective of this study is to understand the obstetric and neonatal outcomes in these highly specialized individuals.

Materials and Methods: This study was conducted at the Punjab Institute of Neurosciences (PINS) and the Department of Obstetrics and Gynecology, Lahore General Hospital, Lahore (LGH). A sample of 25 women who appeared with SCI during pregnancy at PINS were recruited in this descriptive study for data collection. Later, their pregnancy and neonatal outcomes were observed at the specified department of LGH. Descriptive statistics were computed for quantitative and qualitative variables.

Results: The average age of these SCI patients was 28 ± 5.2 years. Most of the women (72%) got SCI during motor vehicle accidents (MVA). Thirteen women got SCI during their first trimester and faced severe complications like termination (12%) and miscarriages (12%) of pregnancies. Thoracic spine injury is the most common type of injury. Further, a Cesarean section was also adopted in 58% of cases, highlighting the potential challenges associated with SCI. A very high (42%) preterm birth rate was also reported in this unique sample.

Conclusions: This study is a unique combination of gynecological and neurological aspects. The majority of the pregnancy outcomes are successful with medical support, however, a significant number of miscarriages and termination of pregnancies were also observed. Understanding these outcomes can aid healthcare professionals in improving prenatal and postnatal care and such SCI patients.

Keywords: Spinal Cord Injury, Pregnant women, Neonatal outcomes, Cesarean section, Preterm Births.

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INTRODUCTION

Physical disability and decline in life expectancy are significant outcomes in the Spinal Cord Injury (SCI).[1] There are 20.6 million people who live with this issue in 2019, and this number is still increasing at a significant pace, as the Global Burden of Disease (GBD) study reported the incidence of 900000 people face this problem each year.[2] Further, women of productive ages share a significant proportion (18%) of this prevalence.[3] These statistics are alarming and can cause a huge and lifelong burden on individuals, their families, and health systems directly and indirectly. However, literature is scarce on the pregnancy outcomes of this specialized population, pregnant women. This limited literature leaves study gaps in understanding the issues faced by pregnant women and the health system, especially in developing countries.

It has been observed that SCI during pregnancy can intensify various existing problems like autonomic dysreflexia (AD), decubitus, urinary tract infections, ulcers, etc.[3,4] Further, several mental health issues, which include depression, anxiety, and substance misuse, have also been associated with SCI.[5] However, all these conditions can worsen in pregnancy due to altered physiological responses, which can lead to a high risk of preterm labor and cesarean section.[6] Literature reported that these outcomes are due to compromised neurologic function that reduces mobility and can enhance the risk of discussed problems.[7]

The etiology of SCI is mainly associated with two main reasons: falls and road injuries, which include motor vehicle accidents (MVA), pedestrians, motorcyclists, and some other road injuries.[2,8] All these causes can worsen maternal and fetal outcomes, however, limited data and research regarding this specific population restrict the researchers from developing some comprehensive framework and guidelines which help health practitioners to deal with such obstetric populations. Therefore, there is a need to have such studies that can provide baseline information on SCI pregnant women, causes, and maternal and neonatal outcomes so that this information can help in designing customized strategies for future practitioners. Additionally, the conceptualization of the interplay between SCI and pregnancy is essential for developing postnatal care strategies.

PATIENTS AND METHODS

Study Design and Settings

This descriptive study was conducted after the approval of the institutional review board (IRB) of Lahore General Hospital (IRB No. 781-B/12/2022). All the pregnant women registered at PINS with SCI were planned to be recruited for this study. These patients were treated for SCI with standard practices, especially with conservative management.

Study Duration and Follow-up Plan

The study duration was 1 and half years (1st January 2023 to 30 June 2024) in which the first 10 months were for the registration of these patients, who further followed up till the neonatal and postpartum outcomes. Therefore, this study took almost 18 months to complete. This study duration was finalized after considering the objectives of the study; the study included a follow-up component to assess long-term maternal and neonatal outcomes beyond the immediate postpartum period. Follow-up of these patients and their pregnancy outcomes was carried out at the Department of Obstetrics and Gynecology, General Hospital, Lahore (LGH).

Data Collection Tool and Ethical Considerations

A questionnaire was designed for data collection from the target respondents, considering the relevant information conceptualized from the

literature. Data was collected through a self-administered questionnaire after informed consent from the respondents. Data confidentiality was maintained, and research protocols adhered to institutional review board guidelines. Information on age, area of residence, cause of SCI, level, severity of injury, obstetrics or pregnancy-related complications, delivery mode, and neonatal health outcomes was recorded.

Inclusion Criteria

The inclusion criteria of study participants were well-defined; pregnant women aged over 18 years who had SCI during pregnancy.

Exclusion Criteria

Women with SCI but got it before pregnancy were excluded from the study. A total of 25 women fulfilled the inclusion criteria of the study and were verified through consultant physicians at PINS. Further, they showed their informed consent to participate in the study.

Data Management and Statistical Analysis

Software version 26.0 for appropriate statistical analysis. This study was mainly descriptive, and descriptive statistics mainly serve the purpose of summarising the baseline characteristics and highlighting patterns, if available in the data. Qualitative variables like the cause of SCI, the severity of injury, etc. were reported in the form of frequency and percentage. Quantitative variables such as age were displayed in terms of means and standard deviations. Some variables were originally quantitative; however, better to report in categorical form; gestational age at the time of SCI. The collected data were entered into SPSS

Table 1: *Demographic and baseline information of women who sustained SCI during pregnancy.*

Variables	Total study participants (n = 25) Frequency (%)
Cause of Injury	
Motor vehicle accidents (MVA)	18 (72.0)
Fall	06 (24.0)
Firearm injury	01 (4.0)
Type of Injury	
Cervical	05 (20.0)
Thoracic	15 (60.0)
Lumbar	05 (20.0)
Level of Injury (Cervical)	**n= 05**
ASIA-A	02 (40.0)
ASIA-B	01 (20.0)
ASIA-C	01 (20.0)
ASIA-D	01 (20.0)
Level of Injury (Thoracic)	**n= 15**
ASIA-A	09 (60.0)
ASIA-B	02 (13.3)
ASIA-C	01 (6.67)
ASIA-D	03 (20.0)
Level of Injury (Lumbar)	**n= 05**
ASIA-A	02 (40.0)
ASIA-B	01 (20.0)
ASIA-C	01 (20.0)
ASIA-D	01 (20.0)
Gestational age at SCI	
1-13 weeks	13 (52.0)
14-27 weeks	07 (28.0)
28-40 weeks	04 (16.0)
Unreported	01 (4.0)

RESULTS

There was a total of 25 participants in this study. Table 1 includes the presentation of demographic and baseline information of the study participants who got SCI during pregnancy and registered at PINS. Table 2 mainly contained the pregnancy-related complications and fetal-related outcomes observed at specified departments at LGH.

Baseline Characteristics of Study Participants

The average age of the study participants was 28 ± 5.2 years. Findings have shown that MVA is the

most prominent cause of SCI. Further, falls from heights like stairs and other places are the second reason for SCI. 1 woman out of 25 cases has got firearm injury that becomes the cause of SCI. Further, SCI was also differentiated into thoracic, cervical, and lumbar regions, and found that most of the women (15/25 (60.0%)) got Thoracic-region based SCI. The level of injury was measured through a scoring system designed by the American Spinal Injury Association (ASIA). 40% of women who were diagnosed with Cervical injury-based SCI had ASIA-A level of injury. Further, 60% of patients got ASIA-A level of thoracic injury. There were almost half (52%) of women who have experienced the problem of SCI during their first trimester of the gestation period. Further, 28% of women got this problem in the second trimester.

Table 2: *Obstetric and neonatal outcomes of women who sustained SCI during pregnancy.*

Outcome	**Frequency (%)**
Outcome of Pregnancy	
Live birth	19 (76.0)
Termination	03 (12.0)
Miscarriage	03 (12.0)
Mode or Method of Delivery	**n = 19 (Live Births or Complete Pregnancies)**
Vaginal	08 (42.0)
Cesarean	11 (58.0)
Complications During Pregnancy	**n =19 (Live Births or Complete Pregnancies)**
Infection of Bladder	06 (32.0)
Infections of Kidney	04 (20.0)
Not aware of contractions	05 (26.0)
Thrombosis or pulmonary embolism	02 (11.0)
Anemia	02 (11.0)
Complications Related to Delivery	**n =19 (Live Births or Complete Pregnancies)**
Autonomic dysreflexia	04 (21.0)
Fetal – Related Complications	**n = 19 (Live Births or Complete Pregnancies)**
Preterm birth	08 (42.0)
Severely low birthweight	03 (15.7)
Abnormal Doppler's	0 (0.0)
PPROM	0 (0.0)
Abruption of Placenta	01 (5.2)
Structural abnormality of fetal	02 (10.4)
NICU admission	02 (10.4)
Not sure	0 (0.0)
Postpartum	**n = 19 (Live Births or Complete Pregnancies)**
Retained products of conception	02 (10.4)
Postpartum depression	04 (21.0)
Breast and bottle-fed	07 (37.0)
Bottle fed	07 (37.0)
Unreported	02 (10.5)

Trends of Obstetric and Neonatal Outcomes In SCI Patients

Outcome related table showed that 3/25 (12%) pregnancies were terminated and the same 12% of women miscarried (see Table 2). There were remaining 76% normal live births. All these live births were singleton. However, doctors had to use the Cesarean mode of delivery in 58% of study participants. There were multiple types of complications which had been reported in the study. 6 out of 19 women who gave birth to live neonates had experienced bladder infection during pregnancies. Further, 26 and 20% of women were not aware of the contractions and had to face the problem of kidney infections, respectively. Anemia and Thrombosis have also been reported as complications in such patients, however, their prevalence was only 11%. There was only one main complication during delivery; autonomic dysreflexia, whose prevalence was 21%. Preterm birth (< 37 weeks) and severely low birth weights are the two main fetal-related complications in this study. The rate of preterm births was 42%. However, there were 15.7% of fetuses who were born with severely low birthweight (< third centile). Lastly, 21% of women had to face postpartum depression.

DISCUSSION

This study investigated the unique population of

SCI during pregnancies is rarely studied in the literature. There were studies in the literature, however, those studies mainly considered the case reports and narrative reviews which indicate that there is a need for high-quality studies that will be based on empirical evidence about this specific population.[9,10] This study explored the causes of SCI during pregnancies, level of injuries, delivery, and fetal-related complications. These findings would help to design a framework that will guide future practitioners to manage such cases considering their potential outcomes.

The average age of the SCI patients was around 27 years which is consistent with a study that reported an average age of 26.6 years.[9] MVA is the most prevalent cause of SCI in this study and it was also found that there were many systematic reviews which also reported similar proportions about MVA.[2,11] Further, the thoracic spine was the most affected region in SCI. There were many reasons behind the high percentage of thoracic spine injuries; rigid structure of T1-T12 as compared to cervical and lumbar regions and higher exposure to trauma like severe accidents and falls from heights etc. However, many studies have also discussed the higher damage of thoracic regions in SCI patients.[9,12]

There were almost half of women who got SCI during the first trimester of the gestation period. There can be various reasons like hormonal changes associated with early pregnancy that can lead to reduced stability and balance. This imbalance leads to higher chances of falling from heights and bathroom falls. Another important reason is that in the first trimester, many women do not know about their pregnancies and they cannot adjust their lifestyle accordingly which leads to more likelihood of getting SCI during pregnancy conditions.[13] Further, there could be undelaying medical conditions like multiple sclerosis, connective tissue disorders, and other spinal deformities that can also increase the risk of SCI in the first trimester. In addition to these reasons, few studies have also reported a higher rate of SCI in the first trimester of the gestation period.[3,14]

Pregnancy outcome is an important concern in this study. It was observed that 6 pregnancies were terminated and miscarried after the SCI. It means the overall rate of these two potential problems is about 24%. This proportion is close to the recent study where it was 21%.[14,15] Further analysis has shown that out of these 6 pregnancies, 5 women got SCI in the first trimester. It indicates that SCI is more dangerous in early pregnancy stages. Therefore, practitioners need to consider these patterns while managing such patients. In this study, most of the deliveries (58%) were through a Cesarean section (CS) procedure. It was different and significantly higher than the 27.3% rate reported by Mazzia and Berndl.[14] There can be multiple reasons behind this higher Cesarean rate in local settings. The foremost is the elective approach of CS for delivery by the patients (almost 44%) as discussed in the recent Pakistani study.[16] Secondly, the adoption of CS trends by practitioners in Pakistan is also increasing (more than 20%) due to multiple reasons especially to reduce the maternal and fetal mortality rates.[17] It means, that higher CS rates cannot be the only reason for SCI in this study. However, another recent study reported higher CS rates in such patients as compared to the general population.[18]

In this study multiple issues have been experienced by SCI patients during pregnancies; infection of the Bladder, infections of the Kidney, not being aware of contractions, Thrombosis or pulmonary embolism, and Anemia. However, infection of the bladder, not aware of contractions, and kidney-related issues are the most common complications reported in this study. These findings are consistent with the literature which has also reported similar complications and patterns of complications.[6,9,14] Further, these studies also reported that SCI can increase the likelihood of spontaneous preterm birth in such patients and a relationship between these two can be established. In our study, the preterm rate was

42% which is significantly higher (18%) than the general population in Pakistani settings.[19] It was also analyzed that patients who got SCI in the second or third trimesters had a higher incidence of neonatal complications. These findings highlighted the importance of early intervention and specialized prenatal care in managing potential adverse outcomes. Further, postpartum characteristics of SCI patients observed in this study have also been consistent with the recent study of Mazzia and Berndl.[14] Postpartum depression has been observed in almost one-quarter of patients which is close to the range (25-37%) estimated and discussed in recent study.[20]

Like every research, this study has limitations. Firstly, this study has focused on an available sample of size 25 which is not a very large sample size in applied research. It is hard to establish relationships between SCI and its potential complications for obstetrics and neonatal outcomes. However, this sample might be large compared to available studies on SCI during pregnancy. The reason is that the study setting (PINS) is famous for its neurological disorder-related services and people usually prefer for treatment. Secondly, recall bias in this study can play a role in causing biases in the findings of the study.

CONCLUSION

This study is a unique combination of gynecological and neurological aspects. There is very limited literature on this study population regarding obstetric and neonatal outcomes. This study concludes that MVA is the most common reason for SCI and Thoracic spine injuries are the common type of SCI in this sample of study. Women within the first trimester are more prone to getting SCI and can have to face severe complications. Further, most of the pregnant women underwent CS procedures for delivery purposes and have to face various kidney and bladder-related infections. The majority of the pregnancy outcomes are successful with medical support, however, a significant number of miscarriages and termination of pregnancies were also observed. Lastly, there are higher chances of preterm births and postpartum depression in this population of study. These findings suggest that there is a need for targeted strategies for patients of SCI with first trimester and prenatal care so that potential complications can be reduced.

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Additional Information

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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Shirin Gul Suhail	1. Study design and methodology.
2.	Omair Afzal	2. Paper writing.
3.	Sumera Zeb and Dr Zahra Safdar	3. Data collection and calculations.
4.	Uzma Zia	4. Analysis of data and interpretation of results.
5.	Madeeha Rasheed	5. Literature review and referencing.
6.	Nabeel Choudhary	6. Editing and quality insurer.