

Original Article

Medical and surgical management of acute spinal injury during pregnancy: A case series in a third-world countryAjmal Zemmar[#], Ahmed Al-Jradi^{1,2,#}, Vincent Ye^{3,#}, Ismail Al-Kebsi¹, Hugo Andrade-Barazarte, Emal Zemmar, Josue Avecillas-Chasin⁴, Iype Cherian², Andrei V. Krassioukov⁵, Juha Hernesniemi

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Abstract

Background: There is scant literature describing the management of acute spinal injury in pregnant patients. Here, we report our experience with five cases of pregnant patients including three females who suffered acute traumatic spinal cord injuries (SCIs).

Methods: This retrospective study evaluated five pregnant women presenting with traumatic spinal injuries over a 16-month period. All were assessed using the International Standards for Neurological Classification of Spinal Cord Injury Patients and the American Spine Injury Association Impairment Scale (AIS).

Results: Three patients sustained SCIs: two cervical spine (C4 AIS-A and C5 AIS-B) and one thoracolumbar junction fracture dislocation (T11 AIS-A). Two patients required surgical stabilization during pregnancy, with one undergoing surgery after delivery. All three patients subsequently delivered healthy newborns. The remaining two patients without neurologic deficits at admission were treated conservatively; one had a healthy child, whereas the other patient aborted the baby due to the initial trauma.

Conclusions: Our study demonstrates that the same surgical principals may be applied to pregnant women as to routine patients with SCIs. Further studies with

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greater patient data should be performed to better develop significant guidelines for the management of pregnant patients with spinal injuries.

Key Words: Autonomic dysreflexia, management, pregnancy, spinal cord injury

INTRODUCTION

Trauma during pregnancy is the leading nonobstetrical cause of maternal death, affecting up to 8% of all pregnancies.^[3,6,11,14,16] Acute spinal cord injuries (SCIs) occur in women of childbearing age (15–40 years) (e.g., incidence up to 20%).^[19] Treatment of this patient population can be particularly challenging due to difficulty with positioning and nursing care and the management of acute/chronic SCI-specific complications (e.g., blood clots, infections, hypotension, autonomic dysreflexia, respiratory and cardiovascular complications, etc.).^[1,15,19-21] Few studies (nine reports including five case reports) focus on the treatment and management of spinal injuries during pregnancy.^[2,8,10,13,17,18] Here, we present five pregnant women with traumatic spinal injuries including three patients with SCI who were treated surgically and delivered healthy newborns.

MATERIALS AND METHODS

From 2016 to 2017, we evaluated five pregnant women who sustained spinal trauma (Al-Thawra Model General Hospital, Sana'a-Yemen). Patient data were retrospectively assessed and included patient age, gestational age, Gravida, mechanism of injury, location of injury, American Spine Injury Association (ASIA) Impairment Scale (AIS),^[5] surgery, length of hospital stay, type of delivery, complications, and obstetric outcomes. This was then combined with a review of the literature regarding “acute SCI” and “pregnancy” (e.g., using Ovid MEDLINE and Embase Databases).

RESULTS

Out of 392 patients with traumatic spinal injury, 19.6% were females of childbearing age (15–40 years) [Table 1]. Five patients were pregnant, of which three had sustained acute SCI involving two cervical fracture dislocations (C4 AIS-A and C5 AIS-B) and one thoracolumbar junction fracture dislocation (T12/L1 AIS-A SCI), whereas two remained neurologically intact with an L1 wedge fracture and a thoracic wedge fracture, respectively [Tables 2 and 3].

DISCUSSION

This series of five cases involving pregnant patients comprises three spinal cord-injured females with neurological deficits requiring surgery and two

neurologically intact patients managed conservatively. The surgical procedures included an anterior C5 corpectomy and C4–6 fixation, an anterior C7 corpectomy and C6–T1 fixation [Figure 1] as well as a T12 laminectomy and T11–L1 posterior instrumentation and fusion [Figure 2]. Four patients delivered healthy babies, whereas one had an abortion due to the initial trauma [Table 4].

Literature review

There are few reports on the management of traumatic spinal injuries during pregnancy.^[4,10,12,17] Brown *et al.* reported three patients who underwent emergent hemilaminectomy for cauda equina syndrome with good outcomes.^[4] In a series of 21 patients with spinal tumors diagnosed during pregnancy and treated surgically, only 2 patients had unclear fetomaternal outcomes.^[12] In another study, seven pregnant patients underwent spine surgery for herniated lumbar disk, tuberculosis, and tumors; six patients had normal deliveries, whereas one had a postoperative therapeutic abortion due to increased risk of fetal damages due to intraoperative fluoroscopy.^[10]

Table 1: Statistics of spinal cord injury patient demographics admitted to a tertiary care center during a 14-month period

	Number of cases	Percentage (%)
Total number of cases	392	100
Males	258	65.8
Females	134	34.2
Childbearing age	77	19.6
Pregnant	5	1.3

Childbearing age was defined as females between age 15 and 40 years

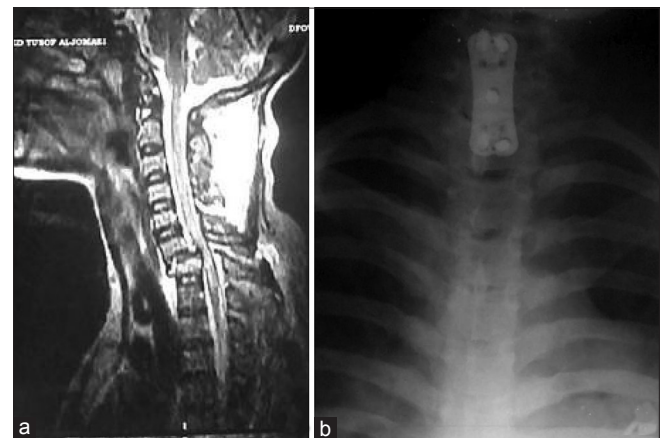


Figure 1: (a) Preoperative MRI scan from case 2 demonstrating a C6/C7 fracture dislocation. (b) Postoperative imaging demonstrating adequate alignment and placement of the anterior plate

Table 2: Summary of clinical and demographic information

Case	Age	GA (weeks) and Gravida/Para	Mechanism	Injury	AIS	Time to operation (days)	Duration of hospitalization (days)	Type of delivery and GA	Other in-hospital complications
1	30	23, G5P3	Fall	C5/6 fracture dislocation	C4 AIS-A	132	154	NVD (35 weeks)	UTI, hypotension, blood transfusion, pressure ulcer
2	26	18, G5P4	MVA	C6/7 fracture dislocation	C5 AIS B	45	248	NVD (36 weeks)	UTI, DVT, blood transfusion, pressure ulcers, hypotension
3	30	17, G3P2	Fall	T12/L1 fracture dislocation	T11 AIS A	1	7		UTI
4	25	20, G3P2	Fall	L1 wedge fracture	–	–	3	C/S (39 weeks)	UTI
5	22	12, G2P1	MVA	T7 wedge fracture	–	–	24	Abortion (12 weeks)	UTI, anemia, multiple trauma
Mean	25.75	18	–	–	–	59	87.2	–	–

GA=Gestation age, NVD=Normal vaginal delivery, C/S=Cesarean section, UTI=Urinary tract infection, DVT=Deep venous thrombosis, AD=Autonomic dysreflexia, AIS=American Spine Injury Association Impairment Scale

Table 3: Level of spinal injury in study patients

Level of injury	Number of cases
Cervical	2
Thoracic	1
Lumbar	2
Sacral	0

Table 4: Obstetric outcomes

	Number
NVD	
Preterm	1
Term	1
C/S	
Preterm	1
Full term	0
Abortion	1
Total	4

NVD=Normal vaginal delivery, C/S=Cesarean section

Impact of positioning in pregnant females for spine surgery

Notably, utilizing the prone position for spine surgery is feasible during the first part of the second trimester but is contraindicated after 12 weeks of gestation.^[10] At this stage, the lateral decubitus position is recommended.^[10]

Management of acute SCI during pregnancy

The management of acute SCI during pregnancy is not well documented in the literature. In a case series of five patients, three were treated surgically and two conservatively with similar outcomes to our study with the exception of one baby dying shortly after delivery, whereas all other newborns were healthy.^[2] The largest study describes nonsurgical management of 45 patients who suffered SCI during pregnancy; although 31 delivered



Figure 2: (a) Preoperative MRI from case 3 showing a T12 fracture dislocation with severe compression of the spinal cord. (b) A postoperative image demonstrating the posterior instrumented fusion

healthy babies, 14 newborns had malformations and/or sustained significant disability.^[9] Another study reported a C7/T1 fracture dislocation and an unstable C5/6 fracture who respectively had a healthy infant, but the latter mother died of complications.^[13] Furthermore, two pregnant patients with SCI from gunshot wounds were treated conservatively and both delivered healthy babies at 37-week gestation.^[7,17] There are other small series that define surgical and/or conservative management strategies for pregnant patients with SCI with varied success [see Table 5].

Timing of surgical intervention versus safety of pregnancy

All three spinal cord-injured patients in this series underwent surgical intervention. Various studies document improved neurological recovery with early

Table 5: Literature review on acute spinal cord injury in pregnancy

Case	Age	GA (weeks) and Gravida/Para	Mechanism	Injury	AIS	Interventions	Type of delivery and GA	Other in-hospital complications
Nnmadi <i>et al.</i>	27	26, G4P3	Fall	C6 spinous process fracture, C7–T1 subluxation	C7 AIS B	Skull Traction	NVD (34 weeks) 2.6 kg	UTI, pneumonia, pressure ulcer, anemia
Nnamdi <i>et al.</i>	35	28, G5P4	MVA	C5/6 unstable	C5 AIS A	–	NVD (28 weeks) 1.2 kg	AD, death
Gilson <i>et al.</i>	30	26, G3P1	MVA	C6/7 bilateral facet fracture with subluxation	C5 AIS A	Skull traction, ACDF with iliac crest graft	NVD (38 weeks) 2.3 kg	ARDS, intubation, hypothyroidism
Popov <i>et al.</i>	21	36, G0	Gunshot wounds	C6/7 fracture with hemicord syndrome	C6 AIS B	–	C/S (37 weeks)	UTI, DVT, blood transfusion, pressure ulcer, hypotension
Gencosmanoglu <i>et al.</i>	21	16, G2P1	Gunshot wounds	C4/5 compound fracture	C5 AIS A	–	NVD (37 weeks) 2.8 kg	Indwelling catheter, anemia
Qureshi <i>et al.</i>	32	19, G1P0	MVA	C6/7 fracture dislocation	C6 AIS B	C7 corpectomy, anterior C6–T11 fusion	C/S (35 weeks) 1.7 kg	Depression, pressure ulcers
Mean	25.75	18	–	–	–	–	–	–

GA=Gestation age, NVD=Normal vaginal delivery, C/S=Cesarean section, UTI=Urinary tract infection, DVT=Deep venous thrombosis, AD=Autonomic dysreflexia, AIS=American Spine Injury Association Impairment Scale

Table 6: In-hospital and obstetric complications

Complication	Number
Abortion	1
Preterm labor	2
Low birth weight	3
DVT	1
AD	1
Bed sores	3
UTI	5
Blood transfusion	2
Depression	3

DVT=Deep venous thrombosis, AD=Autonomic dysreflexia, UTI=Urinary tract infection

surgery.^[22] However, due to potential complications during pregnancy, a detailed multidisciplinary approach is crucial to determine when surgery is optimal in specific cases.

Complications

Complications occurring in these five pregnant patients with SCI included urinary tract infections, sacral pressure ulcers, and deep venous thrombosis, whereas low birth weight was the only complication among the newborns [Table 6]. All fetuses had satisfactory Appearance, Pulse, Grimace, Activity, Respiration (APGAR) scores at 1 and 5 min, and none required prolonged hospitalization.

CONCLUSION

This study demonstrates that successful surgical stabilization and good obstetrical outcomes were achieved

in three pregnant patients with SCI who were managed operatively. Multifaceted treatment options and close monitoring should be continued throughout their hospital stay. Further studies are necessary to evaluate the optimal timing of surgical versus nonsurgical management of these patients.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. ACOG. Obstetric Management of Patients with Spinal Cord Injuries. *Obstet Gynecol* 2002;275:1-3.
2. Arsh A, Darain H, Ilyas SM, Zeb A. Consequences of traumatic spinal cord injury during pregnancy in Pakistan. *Spinal Cord Ser Cases* 2017;3:17041.
3. Brown HL. Trauma in pregnancy. *Obs Gynecol* 2009;114:147-60.
4. Brown MD, Levi AD. Surgery for lumbar disc herniation during pregnancy. *Spine (Phila. Pa. 1976)* 2001;26:440-3.
5. Burns S, Biering-Sørensen F, Donovan W, Graves D, Jha A, Johansen M, *et al.* International standards for neurological classification of spinal cord injury, revised 2011. *Top Spinal Cord Inj Rehabil* 2012;18:85-99.
6. Cusick SS, Tibbles CD. Trauma in pregnancy. *Emerg Med Clin North Am* 2011;25:1-12.
7. Gençosmanoğlu BE, Hanci M, Yücesoy G, Madazli R, Yılmaz H, Özgen M.

- Spinal cord injury caused by gunshot wound during pregnancy. *J Spinal Cord Med* 2001;24:123-6.
8. Gilson GJ, Miller AC, Clevenger FW CL. Acute spinal cord injury and neurogenic shock. *Obstet Gynecol Surv* 1995;50:556-60.
 9. Göller H, Paeslack V. Pregnancy damage and birth-complications in the children of paraplegic women. *Paraplegia* 1972;10:213-7.
 10. Han I-H, Kuh S-U, Kim J-H, Chin D-K, Kim K-S, Yoon Y-S, et al. Clinical approach and surgical strategy for spinal diseases in pregnant women: A report of ten cases. *Spine (Phila. Pa. 1976)* 2008;33:E614-9.
 11. Huls CK, Detlefs C. Trauma in pregnancy. *Semin Perinatol* 2018;42:13-20.
 12. Meng T, Yin H, Li Z, Li B, Zhou W, Wang J, et al. Therapeutic strategy and outcome of spine tumors in pregnancy: A report of 21 cases and literature review. *Spine (Phila. Pa. 1976)* 2015;40:E146-3.
 13. Nnamdi OS, Cajetan N. Traumatic spinal cord injury during pregnancy-Report of twocases. *J Obstet Gynecol India* 2007;57:167-8.
 14. Oxford CM LJ. Trauma in pregnancy. *Clin Obstet Gynecol* 2009;52:611-29.
 15. Paonessa K, Fernand R. Spinal cord injury and pregnancy. *Spine (Phila. Pa. 1976)* 1991;16:596-8.
 16. Petrone P, Jiménez-Morillas P, Axelrad A, Marini CP. Traumatic injuries to the pregnant patient: A critical literature review. *Eur J Trauma Emerg Surg* 2017. doi: 10.1007/s00068-017-0839-x.
 17. Popov I, Ngambu F, Mantel G, Rout C, Moodley J. Acute spinal cord injury in pregnancy: An illustrative case and literature review. *J Obstet Gynaecol (Lahore)* 2003;23:596-8.
 18. Qureshi AZ, Ullah S, AlSaleh AJ, Ullah R. Spinal cord injury during the second trimester of pregnancy. *Spinal Cord Ser Cases* 2017;3:17052.
 19. Sekhon LH, Fehlings MG. Epidemiology, demographics, and pathophysiology of acute spinal cord injury. *Spine (Phila. Pa. 1976)* 2001;26:S2-12.
 20. Sterling L, Keunen J, Wigdor E, Sermer M, Maxwell C. Pregnancy outcomes in women with spinal cord lesions. *J Obstet Gynaecol Canada* 2013;35:39-43.
 21. Verduyn WH. Spinal cord injured women, pregnancy and delivery. *Paraplegia* 1986;24:231-40.
 22. Wilson JR, Tetreault LA, Kwon BK, Arnold PM, Mroz TE, Shaffrey C, et al. Timing of Decompression in patients with acute spinal cord injury: A systematic review. *Glob Spine J* 2017;7:95S-115S.