



Obstetric-associated lower urinary tract injuries: A case series from a tertiary centre in a low-resource setting

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ABSTRACT

Obstetric-associated lower urinary tract injuries may occur during vaginal and abdominal deliveries. If these injuries go unrecognised, these patients may suffer both physical and psychosocial complications. We describe the management of 19 patients with such injuries, including their demographic profile, associated factors, and complications at a tertiary institution in a retrospective case series over a 5-year period. Bladder injuries were the most common (89.5%), mostly occurring during emergency caesarean delivery, with previous caesarean delivery and adhesions being risk factors. A primary repair was attempted at the referring institution in 35.7% of cases. Repair at the tertiary institution was mostly performed by consultants (42.9%). Early recognition and primary repair are found to reduce further complications.

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1. Introduction

Anatomically, the female genital tract and the lower urinary tract are in close proximity to one another. Injuries to the lower urinary tract (LUT) are recognized complications of parturition, but are relatively uncommon during childbirth. The reported incidence of obstetric associated bladder injuries is between 0.14% and 0.94% [1–5], with majority of bladder injuries occurring at caesarean delivery (CD). The incidence of bladder injuries at CD was shown to be 0.4% by Moodliar et al. in 2004 [6]. The incidence of ureteric injuries at CD have been reported to be between 0.013% to 0.09% [1,2,5,7,8]. The current rise in the CD rate may therefore result in an increase in urological injuries during obstetric surgery [1,3,4,7].

The identified risk factors for bladder injuries at emergency delivery include, a previous lower segment CD, adhesions, uterine rupture and caesarean hysterectomy [1,2,5,9,10]. Tarney et al. [2] and Oliphant et al. [5] reported that urological complications occur in 3–6% of caesarean hysterectomies. Incorrect application of forceps or ventouse suction and failure to empty the bladder prior to performing assisted deliveries may result in direct trauma to the urogenital structures [11,12]. Ureteric injuries require a high index of suspicion for early detection [8]. A delay in recognizing bladder and/or ureteric injury may lead to fistula formation, incontinence and renal damage [13]. This in turn may result in

severe physical and psychosocial suffering [2,7,13]. The time of injury to time of recognition and primary repair are important prognostic factors in their outcome [8].

Often, a primary LUT injury, especially if recognized at the time of CD, is managed at the district hospitals without the supervision of a urologist or obstetrician. The obstetric department in many district hospitals in South Africa are managed by medical officers and family physicians. Surgical repair of LUT injuries is, however, not a requirement in the training of a South African obstetrician.

Little is reported with regards to obstetric associated LUT injuries in South Africa. The aim of our case series was to identify and assess the circumstances in which these injuries occur and recommend measures to reduce their risk and improve the success of repair, where necessary.

2. Methods

This was a retrospective case series, carried out at a single centre, Grey's Hospital, a tertiary institution in KwaZulu-Natal Province, South Africa.

The population targeted were obstetric cases referred to and delivered over a 5-year period. Those included were: post-delivery cases referred to or delivered at the tertiary hospital with ureteric, bladder or urethral injury sustained during vaginal delivery or CD, where primary repair was performed at the referring institution or at our tertiary facility, or secondary repair carried out at our facility.

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Exclusion criteria were: all non-obstetric urinary tract injuries, injuries identified outside the puerperium, urinary injuries sustained as a result of non-obstetric pelvic surgery, and patients with pre-existing urogenital abnormalities.

Cases were identified using admission and discharge records from the hospital and the patient records were retrieved from the hospital medical registry. A data collection tool was formulated using Microsoft Word 2017 to extract relevant information from each case record. The data sheet was designed to capture patient demographics, previous mode of delivery, type of delivery, type of injury and the circumstances under which the injury occurred, and information regarding the primary repair of the LUT injury. The information obtained was captured onto Microsoft Excel 2017 and further analysed. The final data analysis was reported utilising mean, range, relative frequencies and tables. Incidence rates are reported with total deliveries for the health district (Umgungundlovu) as the denominator.

Informed consent was not necessary as this was a retrospective study and the patient records were not captured for the purpose of the study. Site approval was obtained from the tertiary hospital and the National Health Research Database. Ethical approval was obtained from the Biomedical Research and Ethics Committee (BREC) prior to embarking on the study. Confidentiality was maintained at all times and the principal investigator was responsible for capturing all data.

3. Results

Nineteen cases were studied with an overall incidence of obstetric associated LUT injuries of 0.02%. The mean age was 28.9 years (range: 20–39 years), and the majority were multiparous (84.3%). Other demographic data are shown in Table 1.

Equal numbers of HIV infected and uninfected cases sustained LUT injuries. Of the patients infected with HIV, 88.9% had been on antiretroviral therapy. The CD4 cell counts ranged from 125 cells/ml to 607 cells/ml, with a mean CD4 cell count of 336 cells/ml. Post-surgical sepsis was identified in one HIV infected patient on antiretroviral therapy with a CD4 cell count of 237 cells/ml.

Referrals were from both district and regional hospitals (52.6% and 21.1%) respectively, with in-house cases accounting for 26.3% of cases. Recognition of LUT injury at the time of delivery was made in 52.6%, and in 26.3% post-delivery; 15.8% were delayed in recognition (Table 2). Primary repair had been attempted prior to referral to our facility in 35.7% of cases (Table 2).

Most LUT injuries occurred during CD (incidence of 0.05%). Only 10.5% of cases occurred during vaginal birth (Table 3). A total of 17 bladder injuries (incidence of 0.05%), 2 urethral injuries and 1 ureteric injury

Table 1
Demographic characteristics of the study population.

	n [%]
Age	
<18 years old	0 [0.0]
18–34 years old	15 [78.9]
>35 years old	4 [21.1]
Mean Age	28.9 years old
Parity	
1	2 [10.5]
2	8 [42.1]
3	6 [31.6]
4+	2 [10.5]
Unknown	1 [5.3]
Weight	
Minimum	53.0 kg
Maximum	140.0 kg
Mean	75.9 kg
Height	
Minimum	141.0 cm
Maximum	172.0 cm
Mean	160.7 cm

Table 2
Data from referring sites.

	n [%]
Referring site	
District Hospital	10 [52.6]
Regional Hospital	4 [21.1]
Tertiary Hospital (In-House)	5 [26.3]
Recognition of injury	
At delivery	10 [52.6]
Post-delivery (<24 h)	5 [26.3]
Delayed	3 [15.8]
Unknown	1 [5.3]
Repair at referring site	
Yes	5 [35.7]
No	9 [64.3]
Number of attempts at repair before referral	
1	5 [100]
2	0 [0.0]
Time of repair at referring site	
At time of injury	5 [100]
Delayed	0 [0.0]

(incidence of 0.003%) were identified. All urethral injuries occurred at vaginal birth whilst all bladder and ureteric injuries occurred during CD, where 94.1% were injuries to the bladder alone and only 5.9% to both bladder and ureter (Table 4).

The surgical expertise at CD varied: 35.3% were performed by a junior medical officer (with <2 years of experience), 23.5% by a senior medical officer (with >2 years of experience), and 23.5% by a registrar (Table 4). A total of 88.2% had a prior history of CD, most being a single previous CD. No case in the study group had >2 previous CD. No patient had undergone prior abdominal or other pelvic surgery. Excessive bleeding (>1 L blood loss) at CD was reported in

Table 3
Type of lower urinary tract injuries and associated factors.

	n [%]
Type of injury	
Urethral	2 [10.5]
Bladder only	16 [84.2]
Ureteric only	0 [0.0]
Bladder and Ureteric	1 [5.3]
Mode of delivery	
Vaginal delivery	2 [10.5]
Instrumental delivery	0 [0.0]
Caesarean delivery	17 [89.5]
Level of expertise at injury	
Midwife	2 [10.5]
Intern	0 [0.0]
Junior medical officer ^a	6 [31.5]
Senior medical officer ^b	4 [21.1]
Registrar	4 [21.1]
Specialist Obstetrician	0 [0.0]
Unknown	3 [15.8]
Previous caesarean delivery	
0	4 [21.1]
1	11 [57.8]
2	4 [21.1]
3	0 [0.0]
Bleeding	
Yes	3 [15.8]
No	11 [57.9]
Unknown	5 [26.3]
Adhesions	
Yes	9 [47.4]
No	6 [31.5]
Unknown	4 [21.1]
Birth weight	grams
Minimum	440
Maximum	4180
Mean	2557.8

^a Junior medical officer - less than 2 years obstetric experience.

^b Senior medical officer - more than 2 years obstetric experience.

Table 4
Caesarean deliveries associated with lower urinary tract injuries.

Type of delivery	n [%]
Emergency	13 [76.5]
Elective	4 [23.5]
Type of injury	
Bladder only	16 [94.1]
Ureteric only	0 [0.0]
Bladder and ureteric	1 [5.9]
Indication for caesarean delivery	
Fetal compromise	1 [5.9]
Cephalopelvic disproportion	3 [17.6]
Failed trial of labour after caesarean delivery	3 [17.6]
Declined trial of labour after caesarean delivery	1 [5.9]
Previous caesarean delivery	7 [41.2]
Other	1 [5.9]
Unknown	1 [5.9]
Level of expertise at injury	
Junior medical officer ^a	6 [35.3]
Senior medical officer ^b	4 [23.5]
Registrar	4 [23.5]
Specialist	0 [0.0]
Unknown	3 [15.8]
Previous caesarean delivery	
0	2 [11.8]
1	11 [64.7]
2	4 [23.5]
Caesarean hysterectomy	0 [0.0]
Bleeding	
Yes	3 [17.6]
No	11 [64.7]
Unknown	3 [17.6]
Adhesions	
Yes	9 [52.9]
No	6 [35.3]
Unknown	2 [11.8]
Skin incision	
Transverse	11 [64.7]
Midline	3 [17.6]
Transverse extended to midline	1 [5.9]
Unknown	2 [11.8]
Uterine incision	
Transverse lower segment	11 [64.7]
Classical	1 [5.9]
De Lee	1 [5.9]
Unknown	4 [23.5]

^a Junior medical officer - less than 2 years obstetric experience.

^b Senior medical officer - more than 2 years obstetric experience.

17.6% and adhesions were reported in 52.9% (Table 4). No caesarean hysterectomies had been performed in the study group (Table 4). At CD, most LUT injuries occurred during an emergency delivery (76.5%). The most common indication for CD was previous CD (41.2%). An analysis of the surgical technique used at CD showed that 64.7% had had transverse skin and transverse lower segment uterine incisions (Table 4).

A total of 12/19 were repaired at our centre with 91.7% success rate following a single attempt at repair. The two urethral injuries were repaired vaginally at our centre (Table 5). Five bladder injury cases had been repaired prior to referral, of which two required further surgical intervention at our centre. Conservative management comprising of free bladder drainage with urinary catheterization was carried out in two cases.

In the single case where both a bladder and ureteric injury had occurred at a regional hospital during an emergency CD for cephalopelvic disproportion, a classical uterine incision had been made. The ureteric injury was managed by ligature removal and placement of a ureteric stent, and the bladder repaired surgically.

Surgical expertise at repair was performed by either a specialist or senior medical officer (42.9% and 21.4% respectively) (Table 5). The senior medical officers in this setting were skilled obstetricians who obtained their qualifications outside of South Africa.

Table 5
Surgical procedures and outcomes at tertiary centre.

Surgical approach	n [%]
Vaginal	2 [10.5]
Abdominal	10 [52.6]
None	5 [26.3]
Unknown	2 [10.5]
Type of repair	
Closure of bladder injury	10
Urethral tear repair	2
Ureteric re-implantation	0
Ureteric resection and re-anastomosis	0
Ureteric stenting	1
Number of repairs at tertiary centre	
0	5
1	11
2	1
Unknown	2
Surgical expertise at repair	
Midwife	1 [7.1]
Junior medical officer ^a	0 [0.0]
Senior medical officer ^b	3 [21.4]
Registrar	1 [7.1]
Specialist	6 [42.9]
Unknown	3 [21.4]
Complications	
High care admission	8 [42.1]
ICU admission	4 [21.1]
Sepsis	4 [21.1]
Breakdown	0 [0.0]
Renal dysfunction	0 [0.0]
Incontinence	2 [10.5]
Urinary retention	0 [0.0]
None	5 [26.3]
Unknown	1 [5.3]

^a Junior medical officer - less than 2 years obstetric experience.

^b Senior medical officer - more than 2 years obstetric experience.

Post-operative morbidity was accounted for by 42.1% being admitted to high care, and 21.1% intensive care; 21.1% were diagnosed with sepsis and 10.5% reported urinary incontinence. No complications were reported in 26.3% of cases and no cases of renal impairment were identified (Table 5).

4. Discussion

The majority of obstetric associated LUT injuries in this case series occurred at caesarean delivery. In this case series, the incidence of obstetric associated LUT injuries at CD (0.05%) was lower when compared to the studies by Oliphant et al. (0.3%) [5], Yossepowitch et al. (0.3%) [8] and Lee et al. (0.08%) [13]. While assisted vaginal delivery is known to be a risk factor for vesicovaginal fistulae in obstetrics, there were no assisted vaginal deliveries in our case series [14].

Our finding that bladder injury commonly occurred during an emergency CD is in keeping with current evidence [2,3,5,8]. At emergency CD, it is thought to be a more stressful environment to expedite delivery and careful dissection may not always be a priority [2,8]. Caesarean hysterectomy has been reported to be a significant risk factor for sustaining obstetric associated LUT injuries, despite there be no such cases reported in this case series [5].

This series demonstrated that previous caesarean section, failed trial of labour after CD and cephalopelvic disproportion were the most frequent indications for CD. As previously highlighted by Rashid et al. [1], Moodliar et al. [6] and Yossepowitch et al. [8] we found previous CD to be a significant risk factor for bladder injury at the of CD. While other reports showed that the rate of bladder injury increases with increasing number of previous CD [2], a single previous CD was the most frequent factor in this case series. The data further suggests that adhesions from a previous CD increases the risk of a bladder injury at the time of CD, which are in keeping with the findings of other studies [3,9,10].

Most caesarean deliveries are performed at district level hospitals suggesting that the standard of surgical training might be declining and efforts should be made in ensuring our junior doctors are receiving appropriate training and exposure.

Our findings that transverse skin and lower uterine segment incisions were most commonly associated with LUT injuries were similar to that of Phipps et al. [3] but differed from those of Tarney et al. [2] who showed that most injuries occurred from midline skin incisions. There is currently limited data on different uterine incisions and urological complications.

Early recognition and repair reduces the risk of complications and can be used as a prognostication tool [1,2,8,13]. In this case series the majority of LUT injuries were identified early and primary repair was not delayed. This correlates with other studies [2,4,7,8], highlighting that intraoperative recognition and early repair can result in satisfactory repair and fewer complications. The surgical expertise at repair may have also contributed to the success of the primary repair, since most were performed by a specialist. The discipline of these specialists varied (obstetrician, urologist and general surgeon). The outcomes of repair were similar to those of high-income countries where senior registrars and obstetricians were present and the urologist was consulted for most cases [8,15].

The complications identified as a result of the LUT injury or the repair in this case series were similar to that of Rahman et al. [4]. Most patients had a prolonged stay in hospital in high care and there had been reports of sepsis and urinary incontinence. Due to most cases being recognized and treated timeously, major complications do not occur frequently [1,4,10]. HIV infection did not appear to have an impact on the outcome of repair, possibly because the mean CD4 cell count of our patients was 336.1 cells/ μ L. CD4 cell counts below 200 cells/ μ L are associated with increased incidence of post-surgical complications [16,17].

5. Limitations

This study was a retrospective case series at a single centre. The data presented are only for patients managed at a tertiary hospital and some cases may have been managed at regional hospitals without being referred to the tertiary centre. Poor record keeping contributed to missing information in patient records cases and may have also resulted in fewer cases being identified during the study period.

6. Conclusion

Preventing LUT injuries at delivery are vital. This case series highlighted that women are at higher risk of sustaining a LUT injury at CD than vaginal delivery. Emphasis on preventing the first caesarean delivery is crucial in reducing the risk of urological and psychosocial complications. Appropriate utilisation and interpretation of the partogram plays a vital role in improving obstetric care. Training in operative vaginal deliveries should occur frequently to reduce the rate of complications during these interventions. All maternity units should have protocols in place when offering trial of labour after CD. This will assist in appropriate patient selection and adequate intrapartum monitoring. In cases where dense adhesions have been identified, sharp dissection rather than blunt dissection should be performed to reflect the bladder. If the anatomy is distorted, filling the bladder may assist with recognizing structures. Prompt management of excessive haemorrhage can improve visibility and reduce the risk of LUT injury. With the recent implementation of surgical competency assessments for CD in South Africa, this may highlight clinicians who may require further surgical training and supervision.

Contributors

Shantel Naicker was responsible for protocol development, data collection, data analysis, manuscript writing.

Thinagrin D. Naidoo was responsible for protocol development, and manuscript editing.

Jagidesa Moodley was responsible for manuscript editing.

Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this article.

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Ethical Approval

Informed consent was not necessary as this was a retrospective study and the patient records were not captured for the purpose of the study. Site approval was obtained from the tertiary hospital and the National Health Research Database. Ethical approval was obtained from the Biomedical Research and Ethics Committee (BREC) prior to embarking on the study. Confidentiality was maintained at all times and the principal investigator was responsible for capturing all data.

Provenance and Peer Review

This article was peer reviewed.

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