

# Iatrogenic bladder injuries during obstetric and gynecological procedures

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## ABSTRACT

**Objective:** To review the frequency of iatrogenic bladder injuries (IBI) occurring during obstetric and gynecological (OBG) procedures and we report a single center experience with these emergency urological consultations and interventions and analyze their outcomes and correlate them with the present day trends.

**Methods:** We reviewed retrospectively the relevant data of all IBI during various OBG procedures from the Medical Records of Abha Maternity Hospital, the OBG wing of Assir Central Hospital, Abha, Saudi Arabia over a period of 4.5 years (September 2000 to February 2005). Various relevant factors of the injuries were studied with their final outcome.

**Results:** Out of the 8,684 OBG procedures carried out during this period there were 20 occasions of IBI directly related, with an overall incidence of 0.23%. The majority of injuries were seen during obstetric procedures (85%) and 15% during gynecological procedures. Notably 90% of them were recognized intraoperatively and managed. Concomitant ureteric injury was noticed in 20% of the cases. Endourological and surgical options were both used in the management. Overall outcomes were very satisfactory, unrelated to the site, type or other associated injuries.

**Conclusion:** The bladder is the most commonly injured organ during OBG interventions. Prompt recognition and repair of injuries should be the main goal. Gynecologists should be able to do at least a minimum diagnostic cystoscopy in emergency situations. It is well established that this can lessen, missing iatrogenic urinary tract injuries in this era of increasing gamut of gynecologic surgical and laparoscopic procedures.

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The anatomic proximity of the reproductive and lower urinary tracts predisposes them to iatrogenic trauma during obstetric and gynecological (OBG) surgery. The bladder and distal ureters are the most commonly involved organs.<sup>1</sup> The bladder is a retroperitoneal structure, its trigone rests over the anterior vaginal fornix and the base rests on the lower uterine segment and cervix. It is most frequently injured during obstetric procedures. An incidence of 61% during obstetric procedures,<sup>2,3</sup> 1.8% during cesarean sections,<sup>2,4</sup> and 1.5% during gynecological surgeries, per 1000 cases have been reported.<sup>5</sup> A history of previous surgeries, endometriosis, radiation therapy, pelvic inflammatory disease, or diverticulitis should caution on risk of injury and suggest for further preoperative evaluation.<sup>2,5,6</sup>

**Methods.** At Assir Central Hospital, which is a tertiary referral center for the southern region, the labor and delivery units and their related operating suites are housed in a separate facility (Abha Maternity Hospital) for OBG. A review of the operating room records from September 2000 to February 2005 was carried out for the number of OBG procedures and number of cases with iatrogenic bladder injuries (IBI) amongst them. Iatrogenic bladder injuries was defined as injuries which occurred unintentionally during or after OBG procedures which needed unplanned repair. Details of OBG problem, past medical and surgical history, indication for the initial surgery and the type of procedure carried out were recorded. In obstetric cases, details of the gravida, delivery, cesarean section (lower segment cesarean section [LSCS]) whether elective or emergency, previous LSCS, association of placental abnormalities were studied. Urological assessment at surgery was carried out by the attending urologist on a case to case basis. Bladder injuries were evaluated with respect to its site and type (cutting, crushing, transection, laceration). Associated ureteric injuries were also sorted out on the same lines. The time of recognition of the injury, the methods

adopted to diagnose and manage, the postoperative complications, duration of hospital stay along with the final outcome were also recorded. Iatrogenic bladder injuries recognized later postoperatively were grouped as early (<24 hours) and late (>24 hours). Cases in which stenting or major repair of bladder was carried out were followed up by the concerned urologist and fully reevaluated at our center. During follow up, patients

underwent ultrasonography, retrograde pyelogram (RGP) or an intravenous urography (IVU) to assess their urinary tract before declaring cured.

We used the Statistical Package for Social Science 9.0 for Windows in analyzing the data.

**Results.** Analysis showed that 8684 OBG procedures had been carried out during this tenure of 4.5 years. There were 20 operations in which urologists were actively involved in tackling IBI. The overall frequency of IBI was 0.23% and 2.3% per 1000 procedures. The mean age of the study group was 32.2 years (range 24-45). Of the 20 cases, 85% (17) injuries occurred during obstetric procedures and 15% (3), during gynecologic interventions. In 20% (4) of cases there were associated lower ureteric injury. The left sided laterality was noticed with ureteric involvement in 3/4 cases during analysis. Of the obstetric procedures, LSCS was carried out in 16 cases with equal distribution of 8 each for elective and emergency LSCS. Only 35% (7) of them had previous LSCS in this series. Primary LSCS alone was carried out in 9 of cases while 6 were LSCS with hysterectomy and another LSCS with bilateral tubectomy (Table 1). Hysterectomies in obstetric cases were indicated for various reasons such as antepartum and postpartum bleeding coupled with multiparity and placental abnormalities. There were 3 cases of placenta previa, 2 of them were a mixture of placenta accreta and placenta percreta each. In the later, the placenta was found invading outside the uterine serosa and extending into the bladder serosa. She also had a previous LSCS and there was extensive bleeding during the hysterectomy resulting in laceration of the bladder dome and posterior wall along with left ureteric injury. Retrospectively, this patient never gave any history of hematuria. Of the 3 gynecological hysterectomies linked with IBI, 2 were fibroid and one for endometriosis wherein a right oophorectomy was

**Table 1 -** Patient characteristics.

Characteristics	N (%)
<i>Age (years)</i>	
24-45 (mean ± SD)	32.2 ± 5.51
<i>Ethnic features</i>	
Saudis	18 (90)
Non-Saudis	2 (10)
<i>Obstetric aspects</i>	
LSCS	16 (80)
LSCS + tubectomy	1
LSCS + hysterectomy	6
(Multigravida + PPH-3, placenta previa -1, placenta previa + accreta -1, placenta previa + percreta-1)	
Elective LSCS	8
Emergency LSCS	8
Previous LSCS	7/17 (41)
Vaginal delivery + PPH	1
<i>Gynecological</i>	3 (15)
Hysterectomy (n=3)	
Fibroid uterus	2
Endometriosis	1
<i>Time of injury recognition</i>	
Per-operative	18 (90)
Post operative	2 (10)
<i>Post operative complications</i>	
Wound infection	3 (15)
<i>Hospital stay (days)</i> (mean ± SD)	16.55 ± 14.58

LSCS - lower segment cesarean section, PPH - post partum hemorrhage

**Table 2 -** Relationship of injury to procedure and management.

Procedures	Bladder injury		Associated injuries (Ureter)	
	N	Management	N + site	Management
<i>Obstetric</i>				
Lower segment cesarean section	9	Repair	2 (left lower ureter)	Exploration + JJ
Lower segment cesarean section + hysterectomy	6	Repair		
Lower segment cesarean section + tubectomy	1	Repair	1 (left lower ureter)	Exploration + JJ
Vaginal delivery + PPH	1	Repair		
<i>Gynecological</i>				
Hysterectomy (N=3)				
Fibroid uterus	2	Repair		
Endometriosis	1	Repair	1 (right lower ureter)	Uretro-ureterostomy + JJ

PPH - post partum hemorrhage, JJ - double J stent

also included (Table 2). In this case again along with a dome laceration of bladder, the right ureter was crushed and transected inadvertently needing, exploration and uretero-ureterostomy with stenting. We noticed that 90% of the IBI were diagnosed intraoperatively in this series, which is not surprising at our center, as soon as there is the slightest suspicion of an IBI, the urologist was called to render his expertise. This again explains the prompt recognition and management of coexisting ureteric injuries. Moreover, our gynecologists are well exposed in identifying IBI due to this established team work experience. Delayed diagnosis of IBI (10% [2]) cases were seen due to complications. One of the cases was referred post LSCS for oliguria and hypotension, which on re-exploration revealed a partially ligated ureter with posterior bladder wall laceration. The other patient (case of normal vaginal delivery), who underwent vaginal suturing for postpartum bleeding was referred for urine leakage due to a large defect in the trigone and posterior wall of the bladder into the vagina. We thoroughly assess the extent of IBI and look for associated ureteric injuries intraoperatively. Any inadvertent cystostomy is used to inspect the insides of the bladder and see for free urine flow from both the ureters; assisted by an injectable diuretic if needed. In cases of doubt, a feeding tube or ureteric catheter is passed up the ureters and if any resistance is encountered, we do a fixed film RGP (as C-arm is lacking), followed by exploration of the suspicious site of obstruction. The bladder defects are sutured in 2 layers with absorbable stitches and the integrity checked by distending the bladder and in some cases dilute methylene blue is used to check for missed IBI. When the bladder rent is small or there is only suspicion of IBI we resort to diagnostic cystoscopy instead of cystostomy. The Foley catheter is kept in all cases for

a minimum of 6-8 days postoperatively. We noticed that most 60% (12) of the IBI were cut with laceration type rather than clean cut (25%). This could be due to the gauze dissection that most gynecologists adopt over sharp dissection, while pushing the bladder away from the lower uterine segment. Regarding the site of IBI we did not see any significant pattern, only a common (20%) involvement of the dome and lateral walls were noted (Table 3). The postoperative complications were mainly wound infections noted in 15% of cases and the mean hospital stay averaged to 16 days. The 4 patients of ureteric injuries underwent stent removal and RGP after 4 weeks and an IVU after 3 months. Other patients were followed up for a period of 6 months and 50% of them up to a year. Routine physical examination, urine analysis and ultrasonography were carried out on OPD basis. There were no complications notable during this period.

**Discussion.** The bladder is the most frequently injured organ during pelvic surgery, most often in OBG procedures. Its incidence increases according to the complexity and local/regional conditions of each procedure.<sup>2,5</sup> Frequencies reported in literature range from 0.2 to 19.5 per 1000, with an overall frequency of 2.6 per 1000<sup>7</sup>, which was similar to that of Peng et al<sup>8</sup> findings. In our study, we noticed it to be 2.3 per 1000, which is much less. Although bladder injury is almost always recognized at surgery, the intraoperative diagnosis of ureteral injury is difficult and requires a high index of suspicion. Only 51.6% of bladder injuries and 11.5% of ureteral injuries were identified and managed intraoperatively.<sup>7</sup> In our series, 90% of the IBI and 75% of associated ureteric injuries were diagnosed intraoperatively. The best approach is prevention by being aware of the predisposing risk factors of IBI (previous surgeries, endometriosis, radiation therapy, pelvic inflammatory disease, or diverticulitis, congenital anomalies). Next step is to avoid lower urinary tract injury, by meticulous and careful surgical technique-identifying, dissecting, and reflecting contiguous lower urinary tract structures during OBG surgery.<sup>9</sup> Injury avoidance begins with careful sharp dissection and limiting blunt dissection, particularly the use of a sponge to mobilize a bladder flap during abdominal and vaginal hysterectomy. Sharp dissection prevents devascularization, laceration, and suturing into the bladder muscularis. Iatrogenic bladder injuries during vaginal hysterectomy usually occurs in or above the trigone. Separation of the vaginal wall from the bladder allows the surgeon to avoid placement of stitches into the bladder muscularis and subsequent formation of vesicovaginal fistula.<sup>10</sup> Several investigators claimed that previous LSCS might be associated with an

**Table 3 -** Distribution of the site and type of bladder injury.

Injuries	N	(%)
<i>Site of injury</i>		
Anterior wall	4	(20)
Dome	5	(25)
Dome + posterior wall	3	(15)
Lateral wall	5	(25)
Posterior wall	2	(10)
Trigone + posterior wall	1	(5)
<i>Type of injury</i>		
Crush + transection of wall	2	(10)
Cut + laceration	12	(60)
Cut	5	(25)
Laceration	1	(5)

increased risk of bladder injury due to dense adhesions formed between the bladder and lower abdomen as well as the lower uterine segment.<sup>11</sup> These adhesions may lead to inadvertent entry into the bladder during their dissection of the uterus. However, in our series only 35% had undergone previous LSCS contrary to these reports but collaborating with similar findings by Yossepowitch et al.<sup>12</sup> We agree with them that in IBI during LSCS may be mainly attributable to the urgent, abrupt and stressful nature of surgery rather than to scar tissue from previous surgery. They also reported the increased incidence of IBI in emergency LSCS may be rapid and possibly uncontrolled development of the bladder flap over the lower uterine segment as well as the need for a wide uterine opening to facilitate immediate fetal extraction. We did not notice any such increased incidence with the type of LSCS. Often, IBI is identified by clear fluid leaking or sudden appearance of a Foley bulb in the operative field, visible laceration or the presence of bloody urine in the bag.<sup>2,10</sup> Routine intraoperative cystoscopy after all major gynecologic operations may facilitate the recognition of a real or potential injury, allowing intraoperative repair. In dicey situations of suspected IBI even in the absence of a cystoscope gynecologists can follow Teloscopy, as described by Timmons.<sup>13</sup> This involves passing a 0/30 degree telescope (easily available in this era of laparoscopy) without any sheath, through the bladder dome via a small cystotomy puncture to observe ureteral patency and the absence of sutures. This procedure allows excellent visualization of the bladder after abdominal procedures without having reposition of the patient and surgeon. Significant improvement in detection was achieved for both bladder and ureteric injuries by resorting to routine cystoscopy during major gynecologic operations.<sup>7,14</sup> Repair at the primary surgery often is easier, more successful, less morbid for the patient, and advantageous for the surgeon from a legal point of view.<sup>15</sup> Delayed diagnosis of IBI is suspected when postoperatively there is oliguria, hematuria, elevated urea/creatinine ratio, lower abdominal pain, distension, ileus or urinary ascites. Sepsis/peritonitis, intra abdominal abscess and fistula formation can also be noticed in these situations. Stress cystography, ultrasonography, abdominal CT/CT cystography, cystoscopy or RGP will be of help in diagnosing these cases.<sup>2</sup> With the advent of increasing number of pelvic laparoscopic procedures the risk of IBI is 2-10 times greater than open procedures.<sup>16</sup> Gas distention of the urine bag during laparoscopy should alert the surgeon. Laparoscopic repair in these situations depends on the size, expertise, adequate view and exposure, and if the ureters or bladder neck is not compromised.<sup>17</sup>

In conclusion, to avoid IBI, the gynecologist should identify high risk cases, evaluate them preoperatively and prepare for eventualities. Simple procedures such

as emptying the bladder preoperatively, or inserting a Foley catheter and monitoring the urine color and out put, having a good surgical exposure, following proper techniques will prevent IBI intraoperatively. When in doubt of a bladder injury distend it with methylene blue diluted normal saline and look for leaks dissect the bladder well and inspect it thoroughly. Better still do a suprapubic teloscopy or cystoscopy as described earlier. When in doubt, do not hesitate to call expert help, failure to recognize bladder or ureteric injury is a venial sin and to miss it or cover it up is much worse is a 'mortal sin'! Following these basic principles will avoid complications, undue anxiety and medicolegal concerns of IBI during OBG surgeries.

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