Urinary tract injuries at caesarean section: prevention and management

This article focuses on predisposing risk factors and mechanism of injury for urinary tract injuries at caesarean section. Tips on prevention of injury are followed by a detailed discussion of the management options when injury occurs.

Iatrogenic injury to the urinary tract may occur during pelvic surgery because of its close anatomical proximity to the reproductive organs. The bladder and distal ureters are the most commonly involved organs. Although caesarean sections have been associated with lower rates of urological complications than other types of pelvic surgery, awareness of possible complications is important to prevent maternal morbidity.

Incidence

A Medline search from 1951 to date using the keywords urinary tract, caesarean section and injury generated 104 articles which were reduced to 76 on limiting to English language and human. The reported incidence of bladder injury at the time of caesarean section ranges from 0.14–0.56% (Feeney, 1959; Phipps et al, 2005). Phipps et al (2005) reported an overall incidence of 0.28%. The incidence in repeat caesarean section was 0.56% and in primary caesarean deliveries was 0.14%. Eisenkop et al (1982) reported an overall incidence of 0.31% (0.6% in repeat sections and 0.19% in primary sections) and 0.09% incidence of ureteric injury. Rajasekar and Hall (1997) reported fewer incidences (0.14% bladder injuries overall and 0.027% ureteric injuries in 11 284 caesarean deliveries). No cases of urethral injuries were found in the Medline search.

Risk factors

Risk factors for urinary tract injuries during caesarean section are classified as follows:

Obstetric factors

These include prolonged labour before section, caesarean section at full cervical dilatation, emergency section for failed instrumental delivery, concurrent uterine rupture and caesarean hysterectomy.

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Surgical factors

Surgical factors can include haste in performing the section, repeat section, surgical skill and experience of the operator. Rajasekar and Hall (1997) reported that all the incidents of urinary tract injuries in their series happened during the early hours of the morning when the junior doctor was often without direct supervision. Dense adhesions, vaginal wall tears, massive intraoperative haemorrhage and attempts to control bleeding, especially during repeat sections, are also predisposing factors.

Anatomical factors

Anomalies of the ureter like duplication or megalo-ureter, distortion of pelvic anatomy by masses or adhesions, and abnormal course of the ureter as a result of pelvic kidney have all been noted as causative anatomical factors.

Types and mechanisms of injury

Bladder injury

Most injuries occur in the dome of the bladder and rarely involve the trigone (Phipps et al, 2005). Bladder injuries occur as a result of a number of factors, including (Faricy et al, 1978; Franzini, 1981; Eisenkop et al, 1982):

- Surgical difficulty encountered while developing the bladder flap over the lower uterine segment. The difficulty is usually caused by scar tissue from previous surgery
- Inadvertent cystostomy during the uterine incision
- Extension of the uterine incision into the bladder may occur along with the extension of incision into the cervix or vagina
- Incision into the vagina rather than the lower uterine segment. With an effaced and dilated cervix, the vagina can be mistaken for the lower uterine segment and it becomes difficult to separate the bladder from the vagina
- Bisection of the bladder during caesarean section and delivery through the bladder has also been reported (Franzini, 1981).

Ureteric injury

Types of injuries include angulation or occlusion by improperly placed sutures, direct ureteric damage from crush or clamp injury, partial or complete transection

and ischaemia (Yossepowitch et al, 2004). The mechanisms of ureteric injury are as follows (Eisenkop et al, 1982; Onura et al, 1997):

- Transection of the ureter as a result of extension of uterine incision into the cervix or vagina
- In attempts to achieve haemostasis, the ureter may be included in a blind, mass ligature
- Less commonly, the extension of the uterine incision into the broad ligament damages the ureter directly
- Ureteric injuries have been reported to occur in association with a ruptured bladder causing avulsion of the distal ureters.

Genitourinary fistulae

Vesicouterine fistulae (*Figure 1*) may develop immediately after caesarean section, manifest late in the puerperium or occur after repeated procedures. The fistulous communication is usually between the posterior supratrigonal part of the bladder and the anterior lower segment of the uterus or, rarely, the cervix. Delayed fistula formation may result from infection, devascularization, clamping or haematoma formation in the urinary bladder. Repeat caesarean section may cause progressive devitalization and scarring of the bladder base injuring its vascular network (Porcaro et al, 2002). Ureterouterine fistulae have been associated with damage caused by a low transverse uterine incision during caesarean section either as a result of extension of the incision or in the process of achieving haemostasis (Saltutti et al, 1994).

Prevention

Primary prevention

Avoiding injury to the urinary tract is possible by following the points mentioned in *Table 1*.

Secondary prevention

When injury does occur, early recognition and repair during the primary surgery tends to result in less morbidity for the patient and a more successful outcome (Yossepowitch et al, 2004).

Management

Bladder injury

Most bladder injuries are apparent intraoperatively. Red vascular appearances of the muscularis, urine draining through the dome, or the visualization of the Foley's bulb are all telltale signs of bladder wall laceration. If there is a suspicion of bladder injury, methylene blue injected into the urethral catheter with observed leakage of blue dye into the abdomen confirms damage. The first step is a thorough evaluation of the extent, size and location of the injury, and a determination of whether the trigone or ureters are involved (*Figure 2*). Most injuries are located in the dome of the bladder and do not involve the trigone or ureters (Davis, 1999).

Bladder dome injury

Simple cystostomy in the dome is closed in two or three layers. The first layer is a simple running closure of the mucosa using 3-0 absorbable suture and the second layer is a running stitch of 2-0 or 3-0 absorbable suture incorporating the submucosa and muscularis. A third running stitch of absorbable suture may be placed in the serosa if the margins can be approximated. Postoperatively, the bladder should be drained for 7 days.

Trigonal or ureteric injury

A minority of injuries extend to the trigone or ureters. Ureteric integrity must be confirmed before repair of the cystostomy. This may be done by a variety of methods as described below. If the ureters are not injured, bladder tear can be closed as above. If ureteric injury is noted then the management is as described below.

Figure 1. Vesicovaginal fistula. a. The plain film shows a lateral view of a cystogram with leakage of dye into the vagina while (b) the computed tomography cystogram demonstrates the fistulous tract from the left side of the bladder into the vagina.

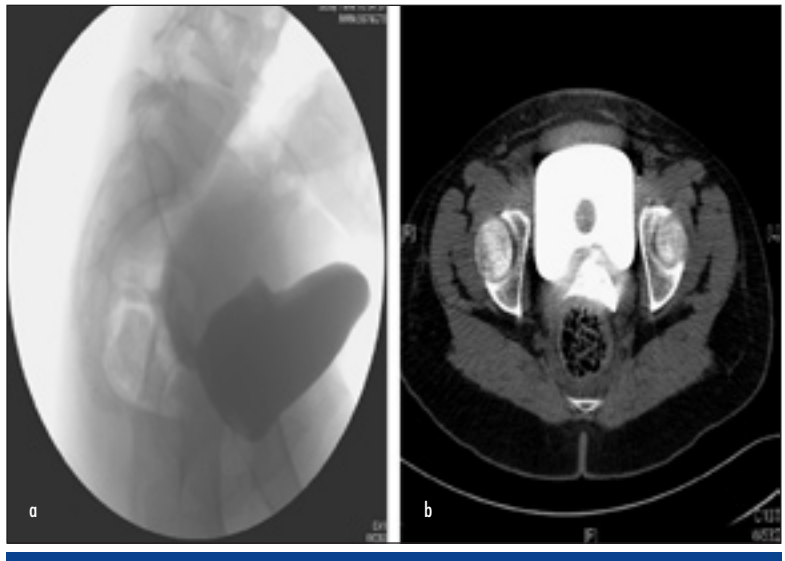


Table 1. Prevention of urinary tract injuries during caesarean section

The bladder should be adequately drained by a Foley catheter before caesarean section except in the direst circumstances
The peritoneal cavity should be entered at the most superior aspect of the abdominal incision, especially in patients undergoing repeat caesarean section
Careful sharp dissection should be used to mobilize the bladder flap adequately in patients with extensive scarring between bladder and lower uterine segment. This provides better visualization of the lower uterine segment and drops the ureters out of the field
The lower uterine scar should be pointing upwards at each end
While attaining haemostasis, it is best to use compression on the bleeding area rather than blind haemostasis sutures
The uterus can be exteriorized for better exposure to suture
If there is any suspicion of ureteric injury, it is best to involve a urologist

Ureteric injury

The management of ureteric injury during caesarean section depends on the nature and location of the defect as well as the timing of the diagnosis of the injury (*Figure 3*). Intraoperative diagnosis of ureteric injury is still very difficult compared with bladder injury (Sorinola and Begum, 2005).

Figure 2. Flow chart for the management of bladder injuries during caesarean section.

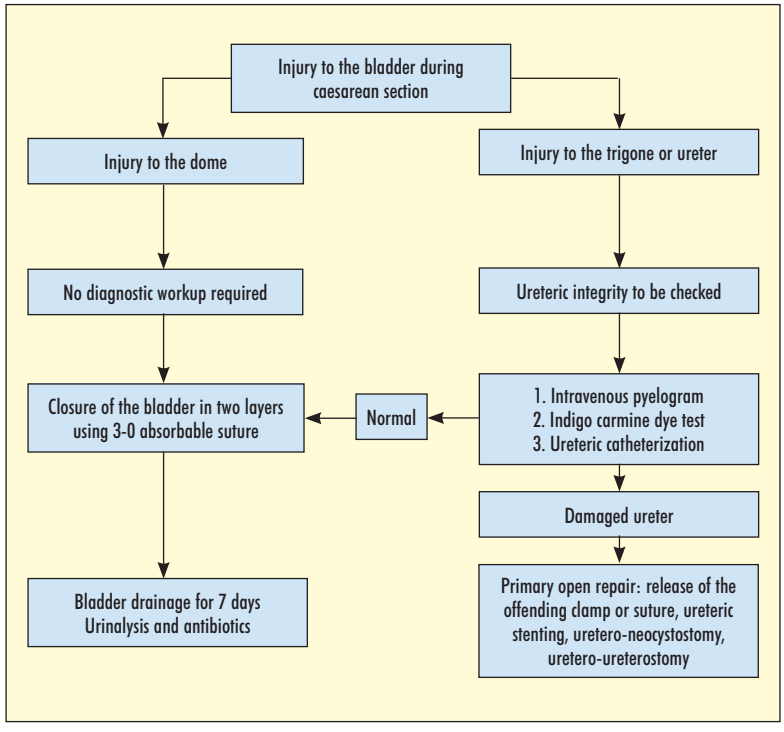
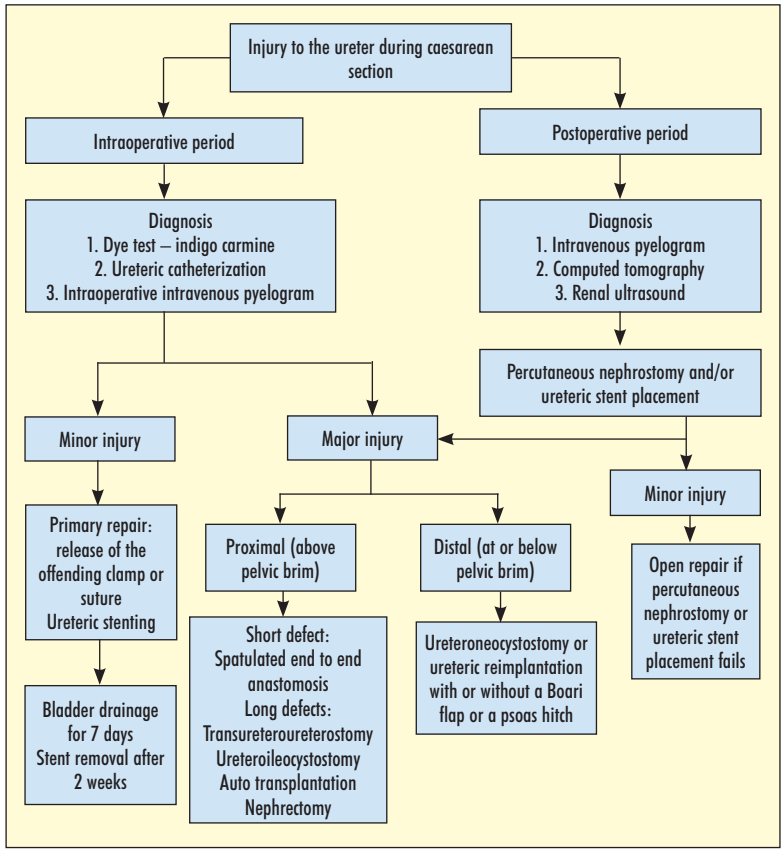


Figure 3. Flow chart for the management of ureteric injuries during caesarean section.



Diagnosis

One or more of the following diagnostic methods may be needed:

Dye test: This involves injection of 5–10 ml of indigo carmine dye intravenously and directly visualizing bilateral spill of blue dye from the ureteric orifices through a cystoscope or cystostomy defect (if the bladder is also injured). If the spill of the dye is symmetric and no dye is noted in the retroperitoneal space, ureteric injury can usually be excluded.

Imaging: An intraoperative intravenous pyelogram may confirm ureteric integrity if dye can be traced in both ureters to the bladder.

Ureteric catheterization: Inserting a ureteric catheter in a retrograde manner through the cystoscope or directly into the orifices following a cystostomy (if the bladder is involved or a cystoscope is unavailable) is probably the preferred diagnostic method (Yossepowitch et al, 2004). There is the possibility of passing a catheter through a partially transected ureter and thus being falsely assured. However, failure to advance the catheter easily through the ureter into the renal pelvis indicates ureteric damage.

Intraoperative period

Minor injury: Those injuries caused by kinking or ligation of a ureter may be treated easily by removal of the offending clamp or suture. Thereafter, if required, a double J, 7F or 8F ureteric catheter can be inserted, as well as a retroperitoneal drain if there is any leakage of urine. A Foley catheter is left in place for 7 days, and the ureteric catheter is removed via cystoscopy after 14 days.

Major injury: Management depends on the location and the extent of injury as detailed in *Figure 3*. Distal ureter injury, such as transection or crush injuries with extensive devascularization, are best treated with ureteroneocystostomy. Tension on the ureter should be relieved by Boari flap or psoas muscle hitch. A suction drain is placed near the anastomosis site to prevent the formation of urinoma. A Foley catheter is left in place for 7 days. The ureteric catheter is left in place for at least 3 weeks and is removed only after ensuring integrity of the repair with an intravenous pyelogram. Extensive injuries to the proximal ureter during caesarean section are rare. When identified, they should be repaired by end-to-end anastomosis for short defects, or transureteroureterostomy for long defects.

Postoperative period

Unrecognized ureteric injury should be suspected postoperatively if a patient experiences:

- Costovertebral angle pain

- Oliguria
- Unexplained or persistent fever
- Persistent abdominal distension with or without ileus
- Unexplained haematuria
- Watery vaginal discharge
- Rise in white cell count and serum creatinine.

Intravenous pyelogram is able to identify ureteric injury in more than 95% of cases. Renal ultrasonography has limited value because of the dilatation of the upper urinary tract during pregnancy and the early postpartum period (Razvi and Denstedt, 1994). To establish urinary drainage, the options include percutaneous nephrostomy tube with or without an antegrade stent or a retrograde ureteric stent placement (Dowling et al, 1986; Razvi and Denstedt, 1994). Placement of a percutaneous nephrostomy tube provides rapid and effective urinary tract drainage and is useful in patients with obstruction or urinary tract sepsis. Additionally, this may be the only procedure required to resolve the ureteric injury (Harshman et al, 1982).

Genitourinary fistulae

Obstetric genitourinary fistula tends to present in various ways. Most patients have urinary incontinence or persistent vaginal discharge. If the fistula is very small, leakage may be intermittent, occurring only at maximal bladder capacity or with particular body positions. Other features include unexplained fever; haematuria; recurrent cystitis or pyelonephritis; vaginal, suprapubic or flank pain; and abnormal urinary stream. The management depends on the type of fistula and its location but there are some key principles that apply to all repairs, which are: accurate diagnosis, timing of repair, appropriate expertise, and detailed postoperative care and follow-up.

Examination under anaesthesia, dye test (methylene blue), cystoscopy, cystogram and/or intravenous urography are important diagnostic investigations. An intravenous urogram is useful where there is suspicion of a ureteric fistula, while the cystogram can diagnose vesicovaginal fistula. Conservative management by bladder catheterization for at least 4 weeks is indicated when the fistula is detected just after the delivery since there is good chance of spontaneous closure (Antonio et al, 2002).

Conclusions

Lower urinary tract injuries during caesarean section are uncommon, but with the ever-rising caesarean section rate injuries can occur. Proper management of injuries is important to minimize patient morbidity. Bladder injury is usually easy to identify and repair. Recognition of ureteric injury is more difficult and management depends on their nature, extent, location and time of discovery. Expert advice is needed in managing fistulae. BJHM

Conflict of interest: none.

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KEY POINTS

- Injury to the urinary tract during caesarean section is not that common but knowledge of the obstetric, surgical and anatomical factors that can predispose to injury is the key to prevention.
- While bladder injury is easily recognized, recognition of ureteric injury is more difficult.
- Early investigation and treatment in ureteric injury can reduce morbidity and save kidney function.
- Genitourinary fistulae are probably under-reported and some go unrecognized, especially as spontaneous healing of small fistulae can occur.
- The type and timing of treatment should be individualized.