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Bladder and Ureter Injuries During Obstetric and Gynecological Procedures

ABSTRACT

Background: Urological injuries are an important matter of a gynecologist especially during hysterectomy and Caesarean section. These complications, although rare, can lead to morbidity and mortality and also can create worry and psychosocial concerns for couples. The most common site liable for injury are bladder and distal ureter .

Objective: The objective of this study is to find out the frequency and kind of urological injuries in obstetric and gynecological procedures.

Patients and method: This Prospective case series study ,performed at Al-Batool maternity teaching hospital, Mosul, Iraq during the period from January 2013 to July 2014 , The study include 21 patients who underwent obstetric and gynecologic surgeries that complicated with Iatrogenic Bladder & Ureter Injury (IBI&IUI).All patient accessed with focus history and examination , Intraoperative and postoperative bladder and ureter injury was recorded and studied.

Results: The results of the study showed that out of 11,861 obstetric& gynecological (OBG) procedures 21(0.18%) patients have urological injuries. The patients ages ranged between 23–55 years [mean ±STD (36.47±7.69 years)] and patients parity 0–12[mean ±STD (4.33±2.56)].

Of the 21 patients who have injury ,17 patients (80.95%) due to obstetrical procedures & 4 patients (19.05%) due to gynecological procedures .13(61.9%)cases were emergency VS 8(38.1%) cases were elective . Among the obstetric procedure 16 (94.11 %) had previous caesarean sections with 11(64.70 %) had more than one scar. Pelvic adhesion of severe type was found in 13 (61.9%) patients. Morbidly adherents placenta in the form of accreta , percreta occurred in 5 patients (29.4%)

The frequency of urological injury (17 case) among all obstetric operastion (11344 case) was 0.15% while the frequency of urological injury(4 cases) among all gynecological operation (517 case)was 0.77% . 50% of bladder injury are of grade 3.

Conclusion and recommendations : Iatrogenic ureteric and bladder injuries from obstetric and gynecologic surgeries though uncommon but are liable to occur. Bladder injury occurred more commonly than ureteral injury ,Possible injury to the urinary tract should be discussed with all patients undergoing a surgical intervention, as it is a recognized complication.

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Introduction:

Urinary and genital tracts of human beings are closely related to each other in both embryological and adult life.[1] Proximity of the female genital system to urinary tract during pelvic surgical procedures can increase risk of injury to urinary system . These sequele , although rare, can result in serious complications for the patients.[2]

The bladder & distal ureters are the most commonly injured organs.[3] Bladder injury can occur during a variety of OBG procedures, including hysterectomy (abdominal, vaginal, laparoscopic/robotic), pelvic organ prolapse (POP) repair, mid urethral sling placement, and cesarean delivery.[4]

The most frequently injured organ during cesarean section operation was bladder . [5] [6] The incidence is about 0.104% - 0.28% . [7] [8] The bladder doom was most commonly involved sit during pelvic operation.[5]

Some factor can increase risk of injury like primary pathological disease distorting normal anatomy or when it is difficult to identify vital organ due to serous operative event like severe bleeding or adhesions[9]. The bladder can sometimes hugely distended in prolonged and obstructed labor. Wrongly, uterine incision may involve the bladder.

Staging:

Iatrogenic injuries to the bladder are staged as follows:

Grade 1: contusion, intramural hematoma or partial thickness laceration

Grade 2: extraperitoneal bladder wall laceration <2 cm

Grade 3: extraperitoneal >2 cm or intraperitoneal <2 cm

Grade 4: intraperitoneal bladder wall laceration >2 cm

Grade 5: intra- or extraperitoneal bladder wall laceration involving the trigone or bladder neck [10]

Iatrogenic ureteric injuries are uncommon complications of abdomino-pelvic surgery but can lead to serious sequele like infection ,sepsis and even

renal loss.[11][12]"Ureteric injury has an incidence of 0.2-1 % during abdominal and pelvic surgery".[13] 0.03% to 2.0% for abdominal hysterectomy, 0.02% to 0.5% for vaginal hysterectomy.

Surgical procedures can result in ureteric injuries involve total abdominal hysterectomy and bilateral salpingo-ophrectomy , radical hysterectomy (Wertheim) and Caesarian section[5][14] Lower third of the ureter is most frequently injured sit (51%), the upper third (30%) is second most commonly involved site while the middle third (19%) has least likely to injured during pelvic operation .[15]. The most common mechanisms of operative ureteral injury are a Crushing from misapplication of a clamp, Ligation with a suture and transection (partial or complete),Urological injuries can be diagnosis either during surgery or following it. Majority of bladder injuries are diagnosed intraoperatively,70% of ureteric injuries are diagnosed postoperatively. [13] Unrecognized injuries may result in chronic complications ranging from various urogenital fistulas to stricture and loss of renal function [1]The study tries to assess frequency and nature of urological injuries in obstetric and gynecological procedures.

Patients & Methods

This is a prospective case series study was conducted in AL-Batool maternity teaching hospital, Mosul city, Iraq, from January 2013 to July 2014. All cases of iatrogenic bladder and ureteral injury who undergo gynecological or obstetric surgery were included in study after obtaining patient consent and medical institute consent .All patients had a detailed history taken including patient's age ,parity, gravida, their chief complaint ,past medical and surgical history (including previous pelvic surgery, previous caesarean section &their number0,1,>1,& if there is any complications during these operations) , indication for current surgery and type of procedures carried out were recorded(Obstetric or gynecological and whether elective or emergency) .

Bladder and ureteral injuries was recorded whether Intraoperative or postoperative (in days) , method of diagnosis whether clinically (direct vision of folly' s catheter , leakage of urine into the operative field, and presence of hematuria , drainage from a surgical incision, increased output from surgical drains ,vaginal leakage, ileus, apparent oliguria or anuria, urinary ascites , Flank pain and fever.) or by later on investigations (renal function test, ultrasonography, retrograde cystogram or CT-scan with contrast study).

For the cases were injury diagnosed immediately at time of operation, the site of injury was recorded. For bladder injury, the injury can be in the (dome, posterior wall ,anterior wall, lateral wall , trigon & posterior wall, fistula). Grading of bladder injury was in the form of grade 1 ,2 ,3 ,4,5.

For ureteric injury ,the site of injury was recorded (right , left, bilateral),level of injury (upper, middle or lower ureter) . Also type of ureter injury was in the form of contusion , ligation , transection , ligation& transection or fistula.

Statistical analysis

Data in study were presented and statically analyzed using Minitab Statistical software version 19. Results were presented as mean standard deviation.

Results

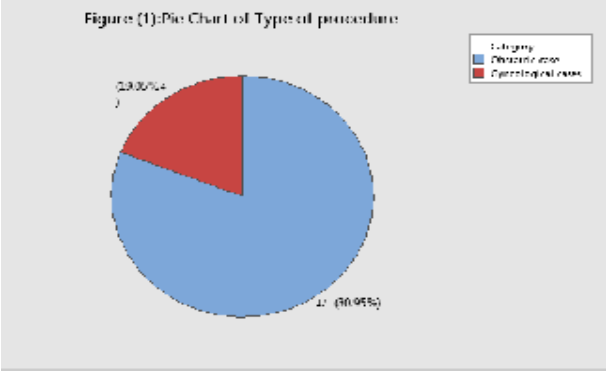
The results of the study showed that , out of 11,861 obstetric and gynecological procedures that had been carried out during one and half year ;21(0.18%) patients have urological injuries. None of the patients have demonstrated to had congenital anatomical abnormalities (0%).

The patients had been divided into two groups according to the age and parity . As shown in table (1) high parity is associated with increasing risk of urinary injury this may be attributed to high chance of caesarean delivery

Table (1) shows the patients characteristic for age and parity.

Age	No. (n.=21)	%	Mean ±SD
20-34 years	7	33.3	36.47± 7.69
≥35 years	14	66.7	
parity			
Nulliparous	1	4.8	4.33± 2.56
Multiparous >1	20	95.2	

Obstetrical operation have high incidence of urinary injury than gynecological interference as shown in figure (1)



Most of obstetrical procedures 13(61.9%) cases were emergency VS 4(19.05%) cases were elective because of absent antenatal care.

Among the urological injuries, 5 cases (23.8%) had no history of previous cesarean section while 16 cases (76.2%) had history of previous caesarean sections. This is because of pelvic adhesion; 11(52.4%) of them had more than one C.S while five of them had one C.S .

Table (2) shows the indication of obstetrical procedure predisposing to urological injury.

As seen in table (2) morbidly adherents placenta cases all ended with intrapartum hysterectomy.

The Obstructed labor occurred in 2 cases are due to midwife interference. The 3

cases of previous one C.S with other indication, are due to failure of progress of first stage of labor in 2 cases of breach presentation .

Table (2) Showed the indication of obstetrical procedure predisposing to urological injury

Indication	No.(n=17)	%
≥2 previous C.S	6	35.3
In labor	4	23.5
Not in labor	2	11.8
Morbidly adherent placenta	5	29.4
accreta	1	5.9
peraccreta	4	23.5
Obstructed labor	2	11.8
Peripartum hysterectomy	1	5.9
Previous one C.S with other indication	3	17.6

Table (3) Showed the frequency of urological injury in OBG

type of procedure	NO.	bladder injury		ureter injury		Combined injury		urological injury	
		NO.	%	NO.	%	No.	%	NO.	%
obstetric	11,344	16	0.14	1	-0.009	0	0	17	0.15
gynecological	517	3	0.58	0	0	1	0.19	4	0.77
total	11861	19	0.16	1	0.008	1	0.008	21	0.18

Table (4) showed the frequency of primary surgeries leading to urological injury.

Surgery	No. of procedures	Bladder injuries		Ureter injuries		Combined injury		Total	
Obstetric procedures		**NO.**	**%**	**NO.**	**%**	**No.**	**%**	**NO.**	**%**
C.S	11294	10	0.09	1	0.01	0	0	11	0.10
C.S without BTL*	11029	10	0.09	0	0	0	0	10	0.09
C.S with BTL	265	0	0	1	0.01	0	0	1	0.01
Intrapartum hysterectomy	50	6	0.05	0	0	0	0	6	0.05
Total	11344	16	0.14	1	0.01	0	0	17	0.15
Gynecological procedures									
TAH±BSO**	215	3	0.58	0	0	1	0.19	4	0.77
Ovarian cystectomy ±oopherectomy	168	0	0	0	0	0	0	0	0.00
Myomectomy	68	0	0	0	0	0	0	0	0.00
Laproscopy	66	0	0	0	0	0	0	0	0.00
Total	517	3	0.58	0	0	1	0.19	4	0.77

*Bilateral tubal ligation

**Total abdominal hysterectomy ± Bilateral salpingophrectomy

Out of 517 patients who underwent gynecological procedures, Only four urological injury cases were recognized during such procedures & one of these cases had combined injury (bladder &ureter). The indication of gynecological operations were malignancy in two cases (one due to ovarian neoplasm & the other due to sarcoma of uterus with metastasis), uterine fibroid (1 case) & dysfunctional uterine bleeding unresponsive to medical treatment (1 case) . The last case was complicated by slipping ligature & had combined injury. All cases had no previous Caesarean section.

Table (5) Showed the site of bladder injury with grading of injury

Site of injury	**Type of injury**			**No.**	%
	grade 1	grade 2	grade 3		
Dome	5	1	4	10	50
Ant. Wall	0	0	1	1	5
Post wall	2	1	2	5	25
Trigon	0	0	0	0	0
Ant. Wall &post.wall	0	0	1	1	5
Dome and Post. Wall	0	1	2	3	15
Total	7	3	10	20	100

There are two cases of ureteral injury, one case in the left side & other in the right side. Regarding grade of injury one was in the form of contusion & other in the form of ligation.

Table(6) showed Timing of diagnosis of urological injury &Management

Diagnosis		
Bladder injury	No.	%
Intraoperative diagnosis	20	100
Postoperative diagnosis	0	0
Ureter injury		
Intraoperative diagnosis	1	50
Postoperative diagnosis.	1	50
Management		
Bladder injury		
conservative	1	5
Bladder repair	19	95
Ureter injury		
Conservative	1	50%
URS+JJ stents	1	50%

All cases of bladder injury were diagnosed intraoperatively (table 6)mostly by direct

vision of folly's catheter followed by hematuria , urine leak into the field. Only one case of IBI was done by urologist for checking of ureters.One case of ureter injury was diagnosed intraoperatively by hematuria due to contusion of right lower third of ureter& managed conservatively. The other case was diagnosed postoperatively (10 days) due to flank pain & managed by Ureterostomy & double j insertion.

Discussion

Iatrogenic urological injuries are a main cause of anxiety to the surgeons and the patients ,It can result in morbidity for long period to the patient. These morbidities may include vaginal leakage of urine, persistent urinary tract infections ,vulval dermatitis, hydroureteronephrosis, and even can end with renal loss.[2]

In this study, the incidence of urinary tract injury was 0.18%. Its incidence is reported to be from 0.5 to 1.5%.[16][17][18] In another study done in Seoul,Korea from 2007 to 2011 "the incidence of urinary tract injury during pelvic surgery was 0.2% to 1%. [19]

In this study, the bladder injury and ureteral injury rate (0.16% , 0.008%) respectively and that of combined bladder with ureteral injury 0.008% which is comparable to other series[1][20][21][22] where bladder injuries rate (1.0% to 1.8%) and ureteric injuries rate (0.4%-2.5%) with bladder injury more frequent than ureteric injury. [16][17][18]

Raut et al in their study[1] described the incidence of bladder and ureteric injuries in gynecological surgery as 1.23% and 0.11% respectively, whereas in obstetric surgery the incidence of bladder and ureteric injury was 0.67% and 0.33% respectively. In this study the incidence of bladder and combined injuries in gynecological surgery was 0.58% and 0.19% respectively, whereas in obstetric surgery the incidence of bladder and ureteric injury was 0.14% and 0.01% respectively which is much less.

Bladder injuries are commonest in this study. Isolation of bladder from lower uterine segment in patients with previous caesarean sections can

increase likelihood of bladder injury, previous surgical procedures with adhesions may result in safe surgical margin obliteration that can make dissection not easy with high risk of injury.

According to the Royal College of Obstetricians and Gynecologists (RCOG), bladder injury in caesarean sections operation estimated to be 1 in 1000 cases [23]. In Saudi Arabia it is 0.44% [24], Karachi 0.46% [25], 0.67% Mumbai[23]. In other reports[7][8], the incidence of bladder injury during cesarean section is about 0.104% - 0.28% . In study done in Abha Maternity Hospital, Asir, Saudi Arabia during 10 years period (2000-2010) the incidence of bladder injury was 0.22%[26] .

In other reports[4][27] , injury rates between 0.02% and 0.5% during cesarean delivery have been noted, with higher incidence in women who have had prior cesarean deliveries.

Ureteral injury is less frequent at the time of cesarean delivery , with a reported incidence of 0.10% to 0.27%.[5] In other reports[15] ,the incidence of ureteric injury during cesarean section was 0.027-0.09% .

In this study , although it is one center experience in Mosul city/Iraq, risk of bladder and ureter injuries during cesarean delivery, respectively, were 0.09% and 0.01% which is less.

Variation in the rate of injury between different studies is obvious because there are many elements increase liability to injury, including the timing of the surgery, the indication for the surgery, the presence of prior cesarean sections and pelvic adhesions experience of the surgeon. Risk factors for bladder and ureter injury during Cesarean section were investigated before. Phipps et al in his study , shows that 67% of bladder injuries associated with previous cesarean delivery versus 32% control group.[7]

In a new study[26], previous caesarean deliveries responsible for 72.4% of bladder injury about 5-times increased risk of bladder injury with is consistent with this study 76.2%.

Chance of injury for patient in labor

was 24% vs. 16% in elective caesarean(RCOG) [23]. In recent study[7][26], Bladder injury more likely to occur during emergency cesarean section as compare to elective cesarean section (87.5% versus 37.5%, P<0.0001) ; this result is comparable to previous studies. despite that some studies [28] describe elective cesarean as risk factor for bladder injury .In this study, 61.9% of cases were emergency (caesarean hysterectomy and caesarean sections for those patients with multiple scars in labor), this may be explained by the fact that poor health knowledge of patients often results in delayed seeking for health services this can increase risk of emergency surgeries.

In a study done in Abha Maternity Hospital, Asir, Saudi Arabia during 10 years period (2000-2010) presence of adhesions occur in 95.8% of urological injuries [26]. Pelvic adhesion in this study occurs in 61.9% of urological injuries.

Intra-abdominal adhesions can increase the risk of bladder injury 6 times where as the risk can increased up to 6 times with presence of adhesions between bladder and the uterus ,this is consistent with other studies [7][8][26].

Placenta previa ,accreta ,peraccreta occurred in 23.8% in this study. This may be explained by increasing numbers of scars. A study describe that even with appropriated preoperative imaging evaluation about 3 from 5 patients with placenta percreta my develop bladder injury during pelvic surgery [29].

“Carley M E et al reported the incidence of bladder and ureter injuries, respectively, which were 5.13% and 1.71% for obstetric hysterectomy”.[13] In another study[30], the incidence of bladder injury during cesarean hysterectomy was 1-4%. In another study[4], injury rates can reach as high as 5%. The incidence of ureteric injury during cesarean hysterectomy was 0.5-8% [15].

In this study, the bladder injury during obstetric hysterectomy was 0.05% while ureteral injuries was 0% which is much less.

Carley M E et al reported the

incidence of bladder and ureter injuries, respectively,which were 0.58% and 0.36%for abdominal hysterectomy [13], while in this study, the rates 0.58% and 0.19% respectively . In other studies[4][31], the overall incidence of bladder injury is thought to be between 0.2% and 2.9% at the time of hysterectomy and that of ureteric injury between 0.03-2%.

Bladder and /or ureteral injury during gynecological operations can predisposed by many factors as previous pelvic radiation, , advanced malignancies, , cervical fibroids, broad ligament fibroids, distorted pelvic anatomy, pelvic adhesions, ovarian neoplasm's ,previous pelvic surgery , active infection, endometriosis, enlarged uterus.[5]

When injury occurs, concomitant bladder and ureter injury is 9.1%[32] whereas in this study it is 0.006%. In another study[32] in the United States, ureteral injury is associated with a 25% co-incidence of injury to the bladder , whereas bladder injury is associated with a 12.5% rate of concurrent ureteral injury. These values are higher than previously suggested.

The majority of bladder injuries occurred at the dome of the bladder[33][13] and this is comparable to this study as 50% of bladder injury was in the dome and 15% in the dome & posterior wall of bladder. The left ureter is injured more frequently than the right and typically the injuries involved the pelvic part of the ureter [22]. Lower third of the ureter is most commonly injured site (51%) during surgical operations while risk of injury in the middle and upper third of ureter was (19% ,30%) respectively.[13]. In this study , we have equal distribution of ureteric injury 50% in the left & 50% in the right ,this is because we had only two cases of ureteric injury. However, the two cases of ureteric injury occurred in the lower third of ureter, one injured by ligation and the other by contusion.

The ability to diagnose an iatrogenic injury to the urinary tract is one of the most critical skills in caring for surgical patients. The surgeon’s ability to successfully diagnose such problems in

a timely fashion, ideally, while still in the operating room, will often determine whether the patient simply stays in the operating room longer suffers significant and perhaps permanent morbidity. In this study, all cases of bladder injury were diagnosed intraoperatively . Bladder injury should be suspected with appearance of urine in surgical field ; however, Urine leakage may not be evident within the surgical field due to bladder decompression with a Foley catheter.

Mann W J et al reported approximately that 70% of ureteric injuries are diagnosed postoperatively.[13] In this study ,50% of ureteric injury (one case) was diagnosed postoperatively following hysterectomy due to partial ureteric ligation.

Postoperatively, a high degree of suspicion is essential to diagnosed patients with urinary tract injuries that are missed during surgery. Patients may had wide range of complaints, based on the time since the primary surgery. Symptoms may include flank pain or costovertebral angle tenderness, fever, ileus, peritonitis, anuria, or frank fistula. Computed tomography imaging with contrast can be useful in postoperative diagnosis of urinary tract injury by its ability to detect intra-abdominal contrast extravasation . Other technique as retrograde urethrographic and intravenous pyelogram can be useful in identifying urinary tract injury in absence of CT-scan.[34]

All cases of bladder injury(except one case managed conservatively) repaired successfully with no recorded morbidity. One case of ureter injury managed conservatively with no recorded morbidity during one month follow up. Other case managed by double j insertion with no morbidity recorded during one month follow up.

The true incidence of accidental operative bladder and ureter injuries is undoubtedly greater than we have reported, as only injuries recognized during surgery or during the postoperative stay were reported. This is the only population of injuries that

can be reliably identified. Other injuries may have presented much later or remained unrecognized, and some patients may have presented with postoperative injury to other medical centers following discharge. [35]

Reference

[1] Saima Gilani, Zubaida Akhtar, Syed Ahmed, Arzoo Bangash, "FREQUENCY AND TYPES OF UROLOGICAL INJURIES IN GYNECOLOGY AND OBSTETRIC PRACTICE IN A TEACHING HOSPITAL," *J Med Sci*, vol. 28, no. 3, pp. 278-281, 2020.

[2] Obarisiagbon EO, Olagbuji BN, Onuora VC, Oguike TC, And e ABA," Iatrogenic urological injuries complicating obstetric and gynecological procedures," Singapore:Med J, 2011,ch 52,sec10,pp 738.

[3]SoundraPandyan GV, Zahrani AB, Awon A-Re, Al_Rashid M, Al-Assiri M, Dahnoun M., "Iatrogenic bladder injuries during obstetric and gynecological procedures," *Saudi Med J*, vol. 28, no. 1, pp. 73-76, 2007.

[4] Occhino JA , Gebhart JB, "Urinary tract injury avoidance and management," *The Female Patient*, vol. 37, pp. 21-26, 2012.

[5] Hammil SL, Rogers RG, "Urologic injury at the time of cesarean delivery," *The Female Patient*, no. 34, pp. 23-27, 2009 .

[6] Dr. Anju Kumari Rani, Dr. Brijesh Singh and Shobhit Kumar, "Urological injuries in gynecological surgery: A review," *International Journal of Clinical Obstetrics and Gynaecology*, vol. 4, no. 2, pp. 409-412, 2020.

[7] Phipps MG, Watabe B, Clemons JL, "Risk factors for bladder injury during cesarean delivery," *Obstet Gynecol j*, vol. 1, no. 105, pp. 156-60, 2005.

[8] Rao D, Yu H, Zhu H, "The diagnosis and treatment of iatrogenic ureteral and bladder injury caused by traditional gynaecology and obstetrics operation," *Arch Gynecol Obstet*, vol. 3, no. 285, pp. 763-5, 2012.

[9] Abd Allah M. El-Mogy, Ahmed G. Abd El-Raouf, Ali G. Ayad, Hany M. Abd El-Aal, "IATROGENIC URINARY TRACT INJURY IN

OBSTETRIC AND GYNECOLOGICAL PROCEDURES: FIVE-YEAR- EXPERIENCE FROM TWO UNIVERSITY HOSPITALS," *Al-Azhar Med. J,* vol. 50, no. 1, pp. 153 - 162, 2021.

[10] Brooks JD ,Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA,, "Anatomy of the lower urinary tract and male genitalia. In:," in *CampbellWalsh Urology. 9th ed.*, Philadelphia, Elsevier, 2007, p. 53–60.

[11] Mahendran HA, Singam P, Christopher HO, Hong GE, Hee TG,Zainuddin ZM, "Iatrogenic ureter injuries: eleven years experience in a tertiary hospital," *Med J Malaysia,* vol. 2, no. 67, pp. 169-172, 2012.

[12] Federico Fontana , Filippo Piacentino , Christian Ossola , Jvan Casarin , Andrea Coppola ,Antonella Cromi 2,3, Anna Maria Ierardi 4 , Gianpaolo Carrafiello , Antonio Basile , Federico Deho ,Fabio Ghezzi , Giulio Carcano , and Massimo Venturini, "Diagnostic and Interventional Radiology Management of Ureteral Iatrogenic Leakage after Gynecologic Surgery," 21 april 2021. [Online]. Available: https://www.mdpi.com/2075-4418/11/5/750#cite. [Accessed 1 octuber 2021].

[13] P. CN, "Urological injuries in gynecology," *The Journal of Obstetrics and Gynecology of India,* vol. 3, no. 57, pp. 203-204, 2007.

[14] Mteta KA, Mbwambo J, Mvungi M, "Iatrogenic ureteric and bladder injuries in obstetric and gynaecologic surgeries," *East Afr Med J,* vol. II, no. 83, pp. 79-85, 2006.

[15] Jha S, Coomarasamy A, Chan KK, "Ureteric injury in obstetric and gynaecological surgery," *Royal College of Obstetrician & Gynaecologist journal,* no. 6, pp. 79-85, 2004.

[16]Aronson MP, Bose TM, "Urinary tract injury in pelvic surgery," Clin Obstet Gynecol, vol. 45, no. 2, pp. 428-38, 2002.

[17] Frankman EA, Wang L, Bunker CH, Lowder JL, "Lower urinary tract injury in women in the United States , 1979-2006," *Am J Obstet Gynecol,* vol. 202, no. 5, pp. 495.e1-5, 2010.

[18] Ozdemir E, Ozturk U, Celen S, Sucak A, Gunel M, Guney G, Imamoglu MA, Danisman AN, "Urinary complications of gynecologic surgery: iatrogenic urinary tract system injuries in obstetrics and gynecology operations," *Clin Exp Obstet Gynecol,* vol. 38, no. 3, pp. 217-20, 2011.

[19]Lee JS, Choe JH, Lee HS, Seo JT, "Urologic complications following obstetric and gynecologic surgery," *Korean J Urol,* vol. 53, no. 11, pp. 795-799, 2012.

[20]Rajendran S, Hodgnett P, O'Hanlon D, Curtain A, Murphy M, "Antegrade deligation of iatrogenic distal ureteric obstruction utilising a high pressure balloon dilatation technique," *Gynecol Oncol,* vol. 114, no. 3, pp. 538-9, 2009.

[21]Oboro VO, Dare FO, Fadiora SO, Aderounmu AO, Adeoti ML, Ajadi AM, "Ureteric injuries following pelvic operations," *East Afr Med J,* vol. 79, no. 11, pp. 611-3, 2002.

[22]Nnabugwu I, Amu O, " Iatrogenic ureteric injuries complicating open obstetric and gynaecologic operations in South East Nigeria - case series," *J West Afr Coll Surg,* vol. 1, no. 3, pp. 98-108, 2011.

[23]Manidip Pal and Soma Bandyopadhyay, "Bladder Injury during Cesarean Section," *Journal of General Practice,* vol. 1, no. 4, pp. 2-4, 2013.

[24]Rahman MS, Gasem T, Al Suleiman SA, Al Jama FE, Burshaid S, Rahman J, "Bladder injuries during cesarean section in a University Hospital: a 25-year review," *Arch Gynecol Obstet,* vol. 279, no. 3, pp. 349-52, 2009.

[25] Ghazi A, Iqbal P, Saddique M, " Bladder and ureter injuries during obstetric and gynaecological procedures," *Pakistan J Surg,* vol. 24, pp. 53-56, 2008.

[26]M. Al-Shahran, "Bladder Injury during Cesarean Section: A Case Control Study for 10 Years," *Bahrain Medical Bulletin,* vol. 34, no. 3, pp. 1-4, Bulletin.

[27]Sharp HT, Swenson C, "Hollow viscus injury during surgery," *Obstet Gynecol Clin North Am,* vol. 37, no. 3, pp. 461-7, 2010.

[28]Gungorduk K, Asicioglu O, Celikkol O, Sudolmus S, Ark C, "Iatrogenic bladder injuries during caesarean delivery: a case control study," *J Obstet Gynaecol*, vol. 7, no. 30, pp. 667-70, 2010.

[29]Ng MK, Jack GS, Bolton DM, Lawrentschuk N, "Placenta percreta with urinary tract involvement: the case for a multidisciplinary approach," *Urology*, vol. 74, no. 4, pp. 778-82, 2009.

[30]Baskett TF, Calder AA, Arulkumaran S, Munro Kerr's, Obstetrics Hysterectomy, Edinburgh: Saunders Elsevier, 2007.

[31]Gonçalves MAG, Anschau F, Gonçalves DM, Marc CS. Ureter: how to avoid injuries in various hysterectomy techniques[online] 2012 [cited2014Jan.22] Available from:http://www.intechopen.com/books /hysterectomy/ureter-how-to-avoid-lesions-in-various-hysterectomytechniques

[32]Babak Vakili,Ralph R. Chesson,Brooke L. Kyle,S. Abbas Shobeiri,Karolynn T. Echols,Richard Gist,Yong T. Zheng,Thomas E. Nolan,, "The incidence of urinary tract injury during hysterectomy: A prospective analysis based on universal cystoscopy," *American Journal of Obstetrics & Gynecology*, vol. 192, no. 5, pp. 1599-1604, 2005.

[33]Francis SL, Magrina JF, Novicki DE, Cornella JL, "Intraoperative injuries of the urinary tract," *Journal of Gynecologic Oncology*, vol. 7, p. 65–77, 2002.

[34] Moulder, J.K. & Cohen, Sarah , " Preventing urinary tract injury at the time of hysterectomy: Four strategies for success," *Contemporary Ob/Gyn*, vol. 58, pp. 28-34, 2013.

[35]Carley ME, McIntire D, Carley JM, Schaffer J, "Incidence, risk factors and morbidity of unintended bladder or ureter injury during hysterectomy," *Int Urogynecol J Pelvic Floor Dysfunct*, vol. 13, no. 1, pp. 18-21, 2002.