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OUTCOME OF URETERIC INJURIES IN ABDOMINAL AND VAGINAL HYSTERECTOMIES

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ABSTRACT: BACKGROUND: Ureteric injury is one of the most serious complications in abdominal and vaginal hysterectomies. It leads to significant morbidity due to ureterovaginal fistulas and potential loss of kidney function. Aim of this study is to evaluate how and why ureteric injuries occur during hysterectomy and to highlight the outcome with appropriate surgical treatment. **METHODS AND MATERIALS:** This prospective and observational study was carried out at the Department of Obstetrics & Gynaecology and Urology, from March 2014 to May 2015. Total numbers of hysterectomies done were 246 that include 144 total abdominal hysterectomies, 61 vaginal hysterectomies and 41 laparoscope assisted vaginal hysterectomy (LAVH). All ureteric injury patients were analysed for incidence, location, type of injury, recognition time and management. **RESULTS:** Incidence of ureteric injury in our study is 0.8%. Types of ureteric injuries were ureteric transection, suture ligation, uretero-vaginal fistula and thermal injury due to surgical diathermy. Interval between surgery and diagnosis of injury varies between immediate during surgery and 2 days to 4 weeks of postoperative period. All the patients had lower ureteric injuries. Bilateral ureteral involvement was seen in one patient and 8 patients had unilateral ureter involvement. Left ureter was involved in all the cases of LAVH. Contrast enhanced CT scan were done for confirmation of ureteric injuries. Psoas hitch with ureteroneocystostomy done in 7 patients, for a patient with ureteric stricture, Double J Stenting followed by ureteral reimplantation with psoas hitch was done after one year. Bivalving of bladder, Boari flap with ureteral reimplantation and psoas hitch was carried out in one patient who had associated vesico-vaginal fistula (VVF) with ureteric injury. All the patients were symptom free and with no evidence of obstruction. **CONCLUSION:** Iatrogenic ureteric injuries are preventable. Timely recognition and intervention has good outcome.

KEYWORDS: Hysterectomy, Ureteric injuries, LAVH.

INTRODUCTION: BACKGROUND: Hysterectomy is the most commonly performed gynaecological surgery. Ureteric injury is one of the most serious complications in hysterectomy. It is often associated with significant morbidity due to uretero vaginal fistulas and potential loss of kidney function, especially when recognized with delay or postoperatively. For these reasons, injuries to the urinary tract, particularly the ureter, is the most common cause for legal problems against gynaecologic surgeons. Ureteric injuries may be an iatrogenic (75%) or from blunt trauma (18%) or from penetrating trauma (7%).¹ Iatrogenic ureteric injuries occurring in open or laparoscopic hysterectomy is often not recognized intraoperatively and result in severe sequelae.² When a ureteral injury does occur, quick recognition of the problem and a working knowledge of its location and treatment are essential in providing patients with optimal medical care.³

The purpose of this study is to evaluate how and why ureteric injuries occur during hysterectomy and to highlight the outcome with appropriate surgical treatment.

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METHODS AND MATERIALS: This prospective and observational study was carried out at the departments of Obstetrics & Gynaecology and Urology of Sri Venkateswara Medical College Hospital & Research Centre, Ariyur, Pondicherry, during the period from March 2014 to May 2015. Informed consent was obtained from all patients. The total numbers of hysterectomies done were 246 from March 2014 to May 2015. In this, the number of total abdominal hysterectomies were 144, vaginal hysterectomies were 61 and laparoscope assisted vaginal hysterectomy (LAVH) were 41. Out of these, nine patients were found to have ureteric injury, in which two patients were from the institution and the remaining were referred patients. The age group of patients, presenting features, cause of ureteric injury, associated vesico-vaginal fistula (VVF), time from injury to the diagnosis, type of ureteric injury, investigations done, treatment of ureteric injury and outcome of treatment were analyzed.

The study included the cases of ureteric injuries due to hysterectomy. The study excluded other gynecological surgeries and patients with injuries due to accidental trauma. The recognition time of injury was arbitrarily divided in to: Intra-operative, early (<1 Week) and late (>1 week) post-operative. Those cases identified intra-operatively were managed per-operatively, while those cases identified post-operatively, underwent various necessary imaging and functional studies before planned intervention, such as clinical examination, ultrasonography of abdomen and contrast enhanced CT scan, when indicated. Cystoscopy performed in all cases to rule out associated VVF. Retrograde ureteric catheterization was done in one patient who presented with stricture. Follow-up ranged from 1 to 6 months, following definitive correction of ureteric injury. Follow-up included routine clinical assessment, ultrasonography and contrast enhanced CT scan in needed cases. Success was defined as symptom free with no evidence of obstruction.

RESULTS: In this study, nine patients were found to have iatrogenic ureteric injuries after hysterectomy. The age of the patients vary Between 27 to 43. The signs and symptoms (Table 1) were continuous dribbling of urine (78%), vaginal pooling (22%), abdominal distention (11%), oliguria (11%), Intra-operative urine leak (11%). Some patients had more than one symptom and sign. The previous surgeries done were open abdominal hysterectomy in two cases and LAVH in seven cases. No predisposing factors were found in any of the patients. All the ureteric injuries were found in the lower ureter. Types of ureteric injury (Table 2) were ureteral transaction in one case, suture ligation in one case, ureterovaginal fistula in 5 cases. Unilateral ureteric injury was in 8 cases and bilateral ureteric injury was in one case. The cause of ureteric injuries was monopolar cautery thermal injury in 4 cases, bipolar cautery thermal injury in 3 cases.

Time of recognition of urological injuries (Table 3) varies between immediate during surgery and 2 days to 4weeks of postoperative period; Per-operative 1 (11%), less than one week 4 (44.5%), more than one week 4 (44.5%). Associated VVF in the supratrigonal region of 1cm in size, in one case was present. Left ureter was involved in all the cases of LAVH. Ultrasonogram revealed left hydroureteronephrosis with pelvic collection in 7 cases and gross abdominal fluid in one case. Intravenous urogram revealed left ureteric fistula in one case. The findings in CT were left ureterovaginal fistula, pelvic collection and gross fluid in abdominal cavity and hydroureteronephrosis. Psoas hitch with ureteroneocystostomy (UNC) done in six patients, psoas hitch with UNC & ureterolysis done in one patient, for one patient with ureteric stricture, Double J Stenting followed by ureteral reimplantation with psoas hitch was done after one year.

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Bivalving of bladder, Boari flap with ureteral reimplantation and psoas hitch (Figure 1) was carried out in one patient who had associated VVF with ureteric injury. Follow up carried up at 1 month, 3 months and 6 months.

DISCUSSION: A significant ureteric injury is defined as any recognized or unrecognized iatrogenic trauma to the ureter that prevents it from functioning properly or effectively.³ The injury may lead to acute or chronic ureteral obstruction (e.g., a ureter that is inadvertently ligated, crush injury or ischemia) or discontinuity (i.e. inadvertent ureteral resection) or The formation of fistulas.³

The most common sites of ureteric injury are lateral to the uterine vessels, in the tunnel of the cardinal ligament, on the lateral pelvic wall just above the uterosacral ligament and base of the infundibulo-pelvic ligament, as the ureters cross the pelvic brim at the ovarian fossa. This is the lower one third course of the ureter. Here, ureter lies anatomically very close to the uterine and ovarian vessels, hence it is often included in the ligature of these vessels.⁴ Hurd et al. (2001) showed that the ureter runs within 0.5cm of the cervix in 12% of women.⁵ Hence, intimate knowledge of the ureteral location is mandatory to avoid ureteric injuries, especially in gynaecologic surgeries.⁴ Thus, surgeon's experience is also an important aspect.⁶ 75% of ureteric injuries are iatrogenic.¹ The most common site of injury is the lower third (74%).^{1,6,7} In our study all the ureteric injuries were at the lower one third of the ureter. Predisposing factors include uterus size larger than 12 weeks' gestation, ovarian cysts 4cms or larger, radiation therapy, advanced stage of malignancy and anatomical anomalies of the urinary tract. In this study, no risk factor was identified. Nevertheless, there is a minimal risk of ureteric injury even without risk factors.^{2,5} In this study, all cases were unintended ureteric injury during hysterectomy.

It occurs in open or laparoscopic procedures and is often not recognised intra-operatively and may result in severe sequelae.⁸ Gynaecologic surgical procedures are the most common cause of ureteric injuries (Table 4) with a higher percentage occurring during abdominal hysterectomy and laparoscope assisted vaginal hysterectomy.^{2,8} In a large retrospective study by Dobrowolski et.al., (2002) out of 340 iatrogenic injuries to the ureter, 73% were gynaecological, 14% were general surgical and 14% were urological in origin.⁹ In one study, abdominal hysterectomy was responsible for 54% of all ureteric injuries, colorectal surgery 14%, pelvic surgery 8% and abdominal vascular surgery for 6% cases of ureteric injury.⁶ In 2002, Carley ME et.al., reported the incidence of bladder and ureter injuries respectively as 0.58% and 0.36% in abdominal hysterectomy, 1.86% and 0% in vaginal hysterectomy and 5.13% and 1.71% in obstetric hysterectomy.¹⁰ Ureteric injury has an incidence of 0.2-1% during abdominal and pelvic surgery with a higher percentage of injuries occurring during abdominal hysterectomies and partial vaginectomies.⁷ Obstetric and gynaecological surgeries account for approximately 50% of ureteric injuries.⁷

In our study the incidence of ureteric injury in hysterectomy surgeries is 0.8%. The types of ureteric injury are, crushing from misapplication of a clamp, ligation with a suture, transection (Partial or complete), angulation of the ureter with secondary obstruction, ischemia from ureteral stripping or electrocoagulation and resection of a segment of ureter or any combination of these injuries.^{2,4} Post-operative injury to the urinary tract can occur due to avascular necrosis and by the kinking and subsequent obstruction over a hematoma or lymphocele. In 2002, Berkman F et.al., reported the incidence of ureteric injury, in the form of complete transection was 61%, excision 29%, ligation 7% and partial transection 3%.¹¹ In our study the types of ureteric injuries were ureteral transection 11%, suture ligation 11%, ureterovaginal fistula 55.5%. Unilateral ureteric injury 89%

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and bilateral ureteric injury 11%. Ureteric injuries with monopolar cautery thermal injury 44.5%, bipolar cautery thermal injury 33% (Table 3). The pathophysiology of ureteric injury depends on the type of injury and when the injury is identified.³ Injury severity scale for the ureter is given in the table 5.^{1,4}

In 1998, Harkki-Siren P et. al., reported the risk of ureteric injury is higher after laparoscopic hysterectomy.¹² In laparoscopic surgery, especially during hysterectomy surgery, injuries mainly occur in the area of the uterosacral ligaments (Grainger et. al., 1990).¹³ Because of the inflammatory adhesions, visualization of the ureter might be difficult, with a higher risk of injury. In laparoscopic surgery, special attention must be paid to ureteral injuries because, in contrast to open surgery where approximately one third of ureteral damage is recognized during the first procedure, the rate of recognition is lower in laparoscopy.¹³ In this study, the ureteric injury in the seven patients of LAVH were not recognized intra-operatively.

Management of ureteric injury depends on the following factors. Time of detection whether intra operative or postoperative, type and severity of injury, anatomical level, mobility of the ureter and bladder, pathology leading to ureteric injury and patient's general condition. Treatment modalities available are immediate removal of suture, ureteral stenting, conservative management with percutaneous nephrostomy (PCN), uretero-ureterostomy, ureteroileal interposition, ureteroneocystostomy with psoas hitch and Boari flap with ureteral reimplantation.¹⁴ Endo-urolologic treatment of small urteric fistulae and strictures are safe and effective in selected cases. In this study, 67% underwent psoas hitch and ureteroneocystostomy, 11% needed psoas hitch with ureteroneocystostomy and left ureterolysis, 11% underwent Boari flap with ureteral reimplantation and psoas hitch and 11% needed DJ Stenting for stricture followed by ureteral reimplantation with psoas hitch that was done after one year.

In our study, psoas hitch with ureteroneocystostomy was done in six cases, which were easily feasible, because the bladders were well distended and would be easily mobilised and fixed to the psoas. Boari flap was done in one case which had associated VVF and it was done only for the purpose of bivalving the bladder. Boari flap in general was not needed in other patients. Since, the successful DJ Stenting would be difficult and as the contrast enhanced CT clearly showed ureteric fistula, retrograde pyelography (RGP) followed by DJ Stenting was not routinely followed in all the cases. None of our ureteric injury was treated on conservative management with or without percutaneous nephrostomy (PCN), as there were evidences of severe high grade ureteric injury in all the patients. Early repair is associated with shorter hospital stay when compared to the delayed repair. In this study there were no complications like stricture, infection, ureteric obstruction and reflux of urine and all the cases were symptom free with no evidence of obstruction.

Prevention of iatrogenic ureteric trauma is based on visual identification of the ureters and cautious intra-operative dissection. Adequate exposure of pelvic organ is a must. Inadequate incision leads to inadequate exposure and dissection. This may lead to blind clamping or suturing. Meticulous care during dissection i.e. not to damage the sheath of ureter, so that longitudinal vessels should not be destroyed. During hysterectomy for benign condition, blind clamping of blood vessels should be avoided. Lifting the uterus well above, before applying clamps can avoid the ureter. By applying single clamp and working very close to the uterus will help to avoid ureter.

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CONCLUSION: Iatrogenic ureteric injury is a serious complication. Every effort should be made to prevent ureteric injuries. Surgeon must have adequate knowledge of abdominal and pelvic anatomy, especially due to the close relation of ureter with adjacent structures. Urologist must be involved early when iatrogenic ureteric injury is suspected. Timely recognition and intervention gives good outcome.

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Presenting Features	Number	Percentage
Per vaginal Urine leak	7	78%
Vaginal Pooling	2	22%
Anuria/Oliguria	1	11%
Abdominal Distension	1	11%
Intraoperative urine leak	1	11%

Table 1: Presenting features of ureteric injuries

Types of Ureteric Injury	Number	Percentage
Suture ligation	1	11%
Ureteric transection	1	11%
Uretero vaginal fistula	5	55.5%
Unilateral ureteric injury	8	89%
Bilateral ureteric injury	1	11%
Monopolar cautery (thermal)	4	44.5%
Bipolar cautery (thermal)	3	33%

Table 2: Types of ureteric injuries

Type of Injury	Intra-operative	Early < 1 week	Late > 1 week
Ureteral transection	1	1	0
Unilateral Ligation	0	1	0
Monopolar cautery	0	2	2
Bipolar cautery	0	1	2

Table 3: Time of recognition and number of urological injuries

Procedure	Percentage
Gynaecologic Vaginal Hysterectomy	0.02 - 0.5
Abdominal Hysterectomy	0.03 - 2
Laparoscopy assisted vaginal hysterectomy	0.2 - 6
Urogynaecologic	1.7- 3
Colorectal	0.3-10
Ureteroscopy Mucosal abrasion	0.3-4.1
Ureteric perforation	0.2-2
Intussusception/avulsion	0-0.3

Table 4: Incidence of ureteral injury in various procedures

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Grade Description
1. Haematoma only
2. Laceration < 50% of circumference
3. Laceration > 50% of circumference
4. Complete tear < 2 cm of devascularisation
5. Complete tear > 2 cm of devascularisation
* Adapted from the AAST.
Table 5: Injury severity scale for the ureter*^{1,4}

Fig. 1: Bivalving of bladder, Boari flap with Ureteral reimplantation

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