**DISSERTATION ON**

# "MANAGEMENT OF URETERIC OBSTRUCTION IN PREGNANCY"

**Dissertation submitted for**
**M.Ch. Higher Speciality Degree Examination**
**Branch IV – UROLOGY**


**DEPARTMENT OF UROLOGY**
**KILPAUK MEDICAL COLLEGE & HOSPITAL**
**GOVT. ROYAPETTAH HOSPITAL**
**CHENNAI**



**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**
**CHENNAI**

**AUGUST - 2009**

# CERTIFICATE

This is to certify that this dissertation "Management of Ureteric Obstruction in Pregnancy" has been done by **Dr.N.S.KUMAR** under our guidance in the Department of Urology, Kilpauk Medical College Hospital & Govt. Royapettah hospital, Chennai, during the period of Higher Speciality Studies in MCh(Genitourinary surgery) from July 2006 to July 2009. Also certified that this work is original.

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# ACKNOWLEDGEMENT

My sincere thanks and gratitude to **Prof. KANAGASABAI.M.D.,** Dean, Kilpauk Medical College, for permitting me to utilize the clinical materials of this hospital.

I have great pleasure in thanking my teacher and guide **Prof. DR. K.THIYAGARAJAN,M.Ch**., (Urology) D.N.B(Urology) Professor & Head of the Department, Department of Urology, Kilpauk Medical College And Govt. Royapettah Hospital for permitting me to use the clinical material and for his valuable advice and encouragement in preparing this dissertation.

I have great pleasure in thanking my teacher and guide **Prof. V. SELVARAJ, M.Ch., (Urology)**, Additional professor, Department of Urology , Kilpauk Medical College for permitting me to use the clinical materials and valuable advice and encouragement in preparing this dissertation.

I have great pleasure in thanking my teacher **Prof. N.MUTHULATHA. M.Ch., (Urology),** for her valuable advice, guidance, and support in preparing this dissertation.

I am very much grateful to **Dr. P.LEELAKRISHNA, M.Ch., (Urology)** for his valuable advice and guidance.

My sincere thanks and gratitude to my teachers **Dr. R.JAYAGANESH, M.Ch., (Urology) Dr. G.SIVASANKAR. M.Ch., (Urology), Dr. A. SENTHILVEL. M.Ch., and Dr.T.SRIKALA. M.Ch.**

I thank my colleagues and staff members helped me in all possible ways.

My sincere thanks to all our patients for their cooperation in conducting the study.

# CONTENTS

# INTRODUCTION

Urolithiasis is the most common cause of nonobstetrical abdominal pain that requires hospitalization among pregnant patients. The relative incidence and rate of recurrent calculi in pregnant patients (1 per 1500 pregnant patients) is similar to that in nonpregnant patients.

Symptomatic stones are found in the ureter twice as often as in the renal pelvis and affect both ureters in equal frequency. Eighty to ninety percent are diagnosed after the first trimester. Urolithiasis in pregnancy is often a diagnostic and therapeutic challenge for multiple reasons. First, potential adverse effects of anesthesia, radiation, and surgery often complicate traditional diagnostic and treatment modalities.

Second, many signs and symptoms of urolithiasis can be found in a pregnancy or may be associated with broad differential diagnoses of other sources of abdominal pathology.

Finally, most stones (64-84%) pass spontaneously with conservative treatment. However, if the calculus does not pass, it may initiate premature labor, produce intractable pain, cause urosepsis in the setting of urinary tract infection, or interfere with the progression of normal labor.

Of the various imaging modalities currently available, renal ultrasonography has become the first-line screening test for urolithiasis in pregnant patients, while limited intravenous pyelography (IVP) or CT scanning is reserved for more complex cases.

Treatment of stones in pregnancy ranges from conservative management (eg, bed rest, hydration, analgesia) to more invasive measures (eg, stent placement, ureteroscopy with stone manipulation, percutaneous nephrostomy). With appropriate diagnosis and management, the outcome for both the mother and baby is excellent.

# AIM OF THE STUDY

1. To analyse various diagnostic procedures in the management of ureteric obstruction during pregnancy.

2. To assess the various therapeutic modalities during pregnancy in the management of ureteric obstruction.

3. To discuss the factors which decide selection of procedures.

4. To analyse the complications associated with ureteric obstruction in pregnancy and its management.

5. To analyse the outcome.

# MATERIALS AND METHODS

Our study is a prospective study of management of ureteric obstruction for the period from July 2006 to March 2009 at our institutions, Govt Royapettah Hospital & Kilpauk Medical College Hospital.

My study consists of about 20 pregnancy patients presented with ureteric obstruction from age group of 20 to 29 years.

All pregnant patients with signs and symptoms of ureteric colic were included.

All patients screened with

- Urine analysis,
- Urine culture and sensitivity,
- Renal parameters,
- Hemogram and
- Ultrasound abdomen.

Trans vaginal ultrasound was done in symptomatic patients who were not showing stones in USG abdomen and stones in lower ureter.

Color Doppler ultrasound done in patients who were not showing stones in other modalities of above investigations.

All patients were initially treated with conservative line of management.

**Indications for intervention :**

- Intractable pain unresponsive to maximal conservative measures.
- Urosepsis
- Azotemia
- Premature labour not responding to Tocolytics.

**TREATMENT MODALITIES**

1. Stenting under local anaesthesia.
2. URS / Lithotripsy under spinal anaesthesia

All patients were followed up till stone clearance or till delivery.

# RESULTS

Among 20 patients, 2 in I trimester, 10 in II trimester and 8 in III trimester.

The age group included in this study between 20-29 years. The patients with right sided ureteric obstruction was 13 and left sided ureteric obstruction was 7. All patients presented with ureteric colic and 9 patients presented with microscopic hematuria and 3 patients with UTIs.

USG abdomen done for all 20 patients and all of them showed HUN. In addition, 9 patients showed calculus ( 5 in upper ureter and 4 in lower ureter).

Trans vaginal USG done in patients with lower ureteric calculus and HUN without calculus in USG. Additional 5 lower ureteric calculus were detected by trans vaginal USG.

The color Doppler USG done in patients who were not showing calculus but HUN in USG abdomen and trans vaginal USG.

The color Doppler showed obstruction in 4 out of 6 patients and no obstruction in 2 patients.

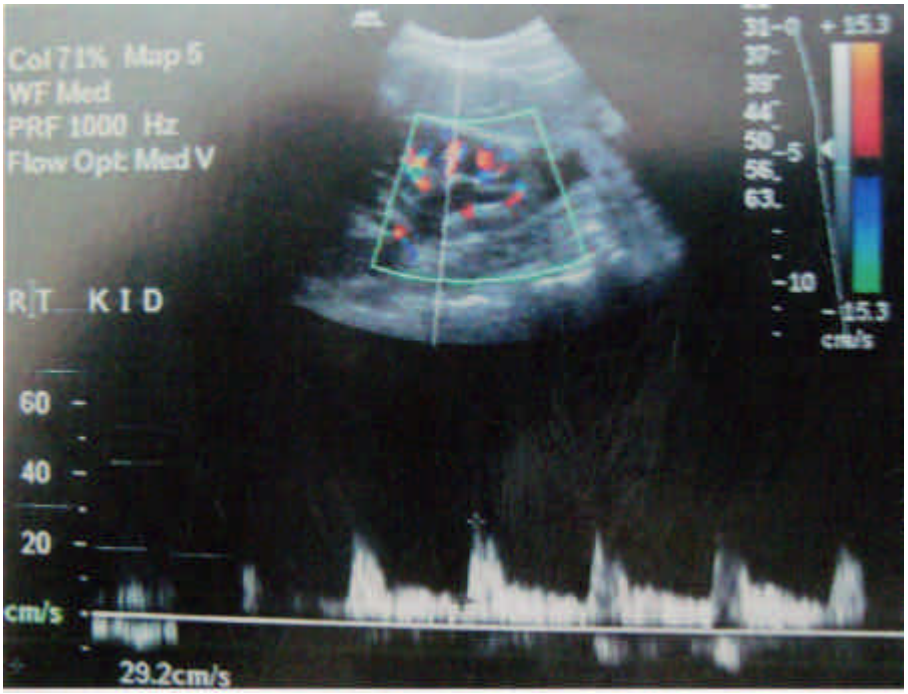
**The criteria for obstruction in Doppler study**

1. Resistive Index : > 0.7
2. Difference between affected and unaffected side is 0.04
3. No ureteric jets or decreased flow of urine on the obstructed side.

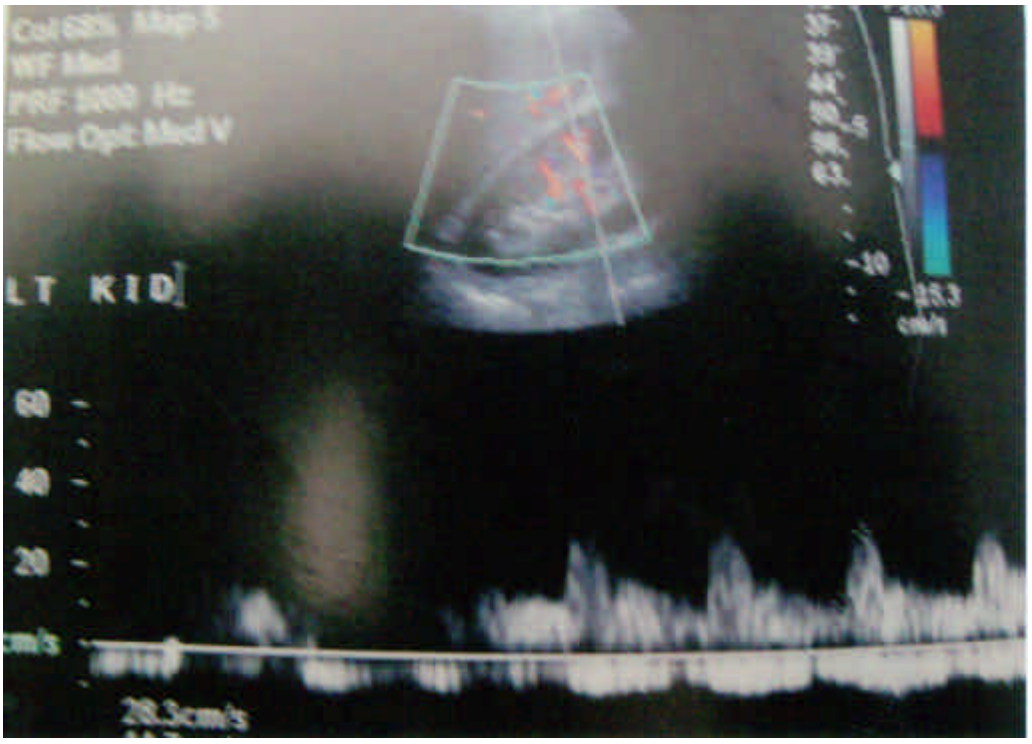
The stone size in this study was variable between 4-8 mm.

- 4-5mm stone- 3 patients
- 5-6mm stone- 7 patients
- 6-7mm stone- 6 patients
- 7-8mm stone- 2 patients.

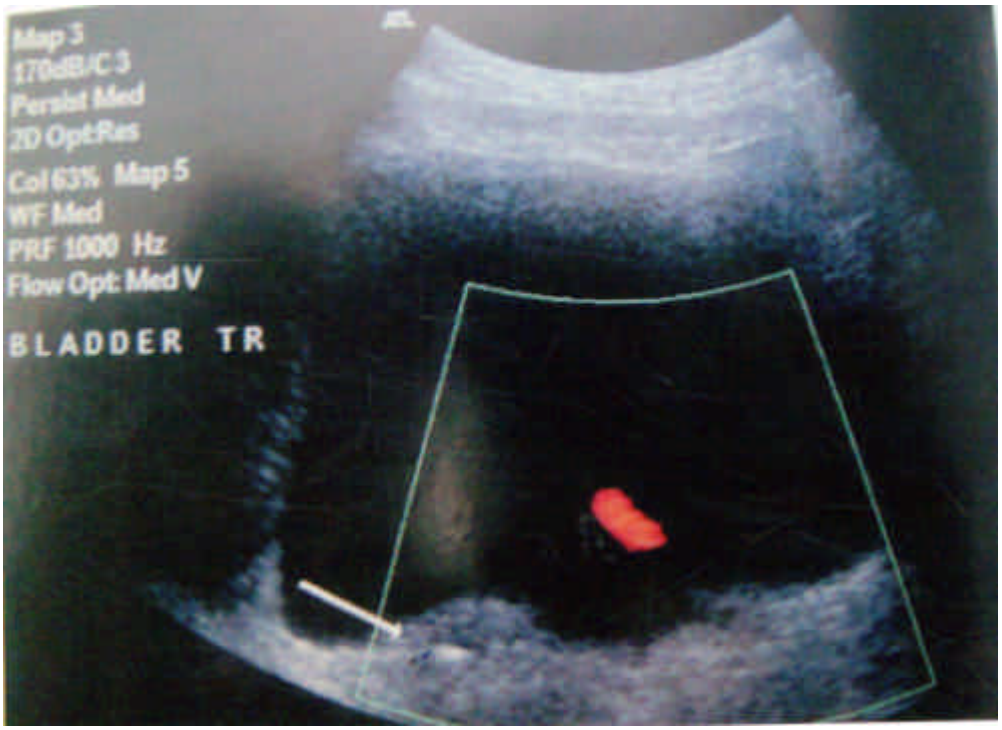
**COLOUR DOPPLER ULTRA SOUND**




**Obstructed Kidney RI - 0.75**



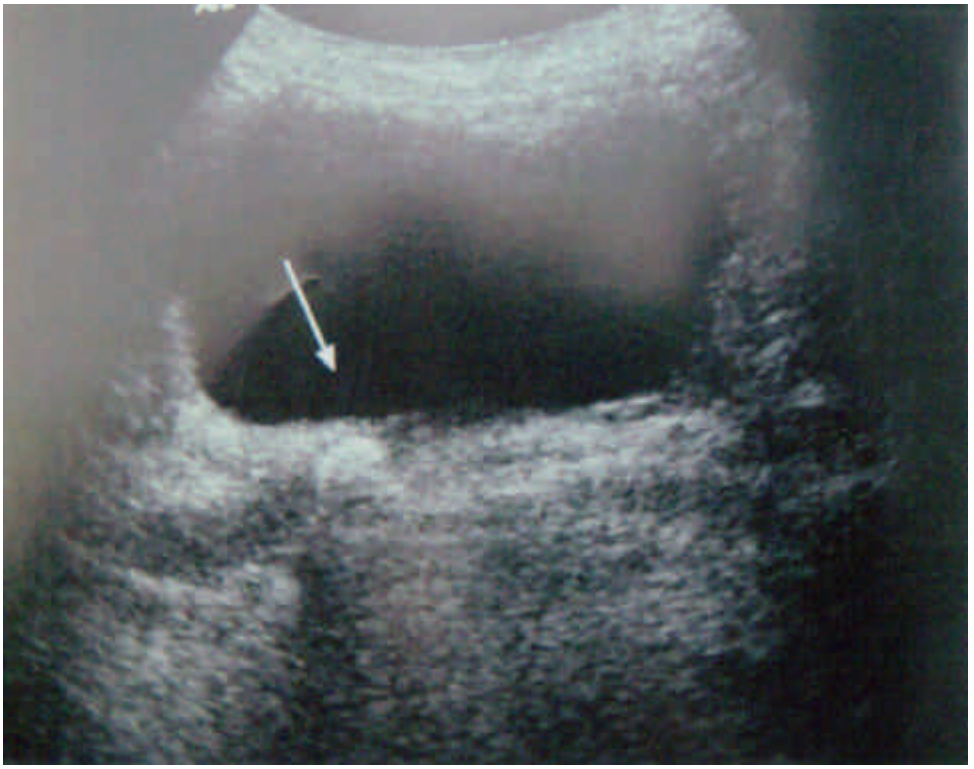

Contralateral Kidney RI - 0.59




**COLOUR DOPPLER ULTRASONOGRAM** - Calculus impacted right UV Junction.

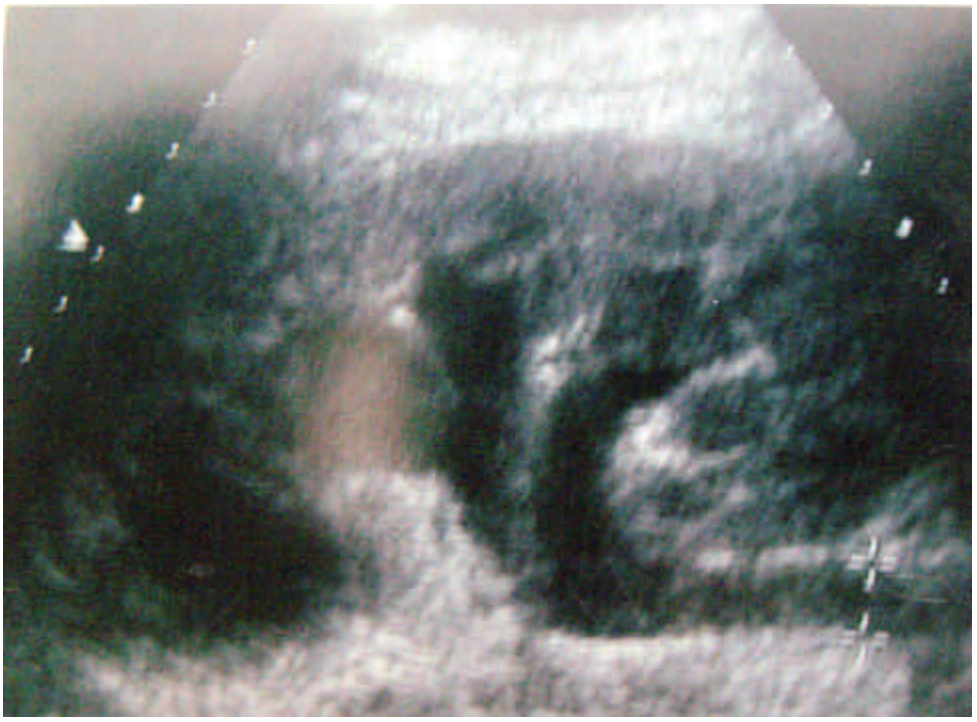
Right uteretric jet not identified.

Left uteretic jet seen



**TRANSABDOMINAL ULTRASONOGRAM**

Calculus impacted right UV Junction.



**TRANSABDOMINAL ULTRASONOGRAM**

Hydroureteronephrosis

All 20 patients were treated initially with conservative line of management. 11 patients developed intractable pain and 3 patients developed signs of urosepsis like fever and vomiting. These patients were managed with interventional procedures.

## CONSERVATIVE TREATMENT ONLY

| NO | PTS ID | WEEKS PREG | GRAVIDA | PRESENTATION | USG | STONE SITE | FATE OF STONES | DELIVERY |
|---|---|---|---|---|---|---|---|---|
| 1 | F | 24 | PRIMI | P.PAIN HEMATURIA | HUN/ CAL | LOWER | SPONTANEOUS | NORMAL |
| 2 | I | 22 | G2 | L.PAIN HEMATURIA | HUN/ CAL | LOWER | SPONTANEOUS | NORMAL |
| 3 | J | 32 | G2 | R.PAIN HEMATURIA | HUN/ CAL | LOWER | SPONTANEOUS | NORMAL |
| 4 | M | 24 | PRIMI | R.PAIN | HUN/ CAL | LOWER | SPONTANEOUS (Post Partum) | LSCS |
| 5 | P | 34 | PRIMI | L.PAIN | HUN/ CAL | UPPER | URS (Post Partum) | LSCS |
| 6 | Q | 32 | PRIMI | R.PAIN | HUN/ CAL | LOWER | SPONTANEOUS (Post Partum) | LSCS |
| 7 | S | 28 | PRIMI | L.PAIN HEMATURIA | HUN/ CAL | LOWER | SPONTANEOUS | NORMAL |

In all 7 patients USG revealed HUN/CALCULUS. Upper -1 Lower- 6

3 patients 2nd trimester

4 patients 3rd trimester

Spontaneous passage of stones 6/7

In P patient- URS done after delivery. (LSCS).

Observation done in 2 patients with out obstruction in Doppler study and followed until delivery**.**

## OBSERVATION

| NO | PTS ID | WEEKS PREG. | GRAVIDA | PRESENTATION | USG | SITE | DOPPLER USG | TREATMENT | POST PARTUM TREATMENT | DELIVERY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B | 32 | PRIMI | R.PAIN | HUN | - | - | OBSERVATION | NAD | NORMAL |
| 2 | N | 30 | G2 | L.PAIN | HUN | - | - | OBSERVATION | NAD | NORMAL |

These 2 patients – USG showed only HUN. No evidence of calculus.

Doppler USG revealed no obstruction.

Followed after delivery. IVU was taken. No evidence of stones / obstruction.

Rest of the 11 were treated with other modalities of management. 7 patients underwent stenting and 2 were developed stent related complications like stent encrustation and stent expulsion. These two patients underwent URS and Lithotripsy.

## STENTING

| NO | PTS I.D | WEEKS PREG | GRAVIDA | PRESENTATION | USG | SITE | CON | STENT | STENT CHANGE | DELIVERY | STONE TRT. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | C | 14 | PRIMI | L.PAIN UTI | HUN/ CAL | LOWER | + | + | 3 | N | SPONT. POST PARTUM |
| 2 | G | 22 | G2 | R.PAIN HEMATURIA | HUN/ CAL | UPPER | + | + | 2 | LSCS | URS POST PARTUM |
| 3 | K | 25 | G2 | R.PAIN | HUN/ CAL | LOWER | + | + | 1 | LSCS | SPONT |
| 4 | O | 20 | PRIMI | R.PAIN HEMATURIA | HUN/ CAL | UPPER | + | + | 1 | LSCS | SPONT |
| 5 | T | 18 | PRIMI | R.PAIN | HUN/ CAL | UPPER | + | + | 2 | N | URS POST PARTUM |

- All patients USG revealed HUN/ Calculus upper3/ lower2
- For all patients stent used
- Stent changed every 12 weeks
- In patient C stent encrustation within 3 weeks. So stent changing 14/17/ 29 weeks of pregnancy
- In patient T, stent expulsion at 12 weeks.

Under LA , stenting done with the help of 20Fr cystoscope . Stent position is confirmed by USG. 5 patients followed up till delivery. Within this patients 2 developed complications like stent encrustation and stent expulsion.

The other modality of treatment in 4 patients were URS and lithotripsy. 2stenting complicated patients also included in URS management.

## RESULTS URS/ LITHOTRIPSY

| NO | PTS I.D | WEEKS PREGNANCY | GRAVIDA | PRESETATION | USG | SITE | DOPPLER USG | CON | STENT | URS | DELIVERY |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 20 | PRIMI | R.PAIN,HEMATURIA | HUN CAL. | UPPER | - | + | + | + | NORMAL |
| 2 | D | 11 | PRIMI | R.PAIN | HUN CAL | LOWER | - | + | + | + | NORMAL |
| 3 | E | 18 | PRIMI | R.PAIN,HEMATURIA,UTI | HUN | - | OBSN- | + | | + | LSCS |
| 4 | H | 20 | G2 | R.PAIN | HUN | - | OBSN- | + | | + | NORMAL |
| 5 | L | 22 | PRIMI | L.PAIN,UTI | HUN | - | OBSN- | + | | + | NORMAL |
| 6 | R | 20 | PRIMI | L.PAIN HEMATURIA | HUN | - | OBSN | + | | + | LSCS |

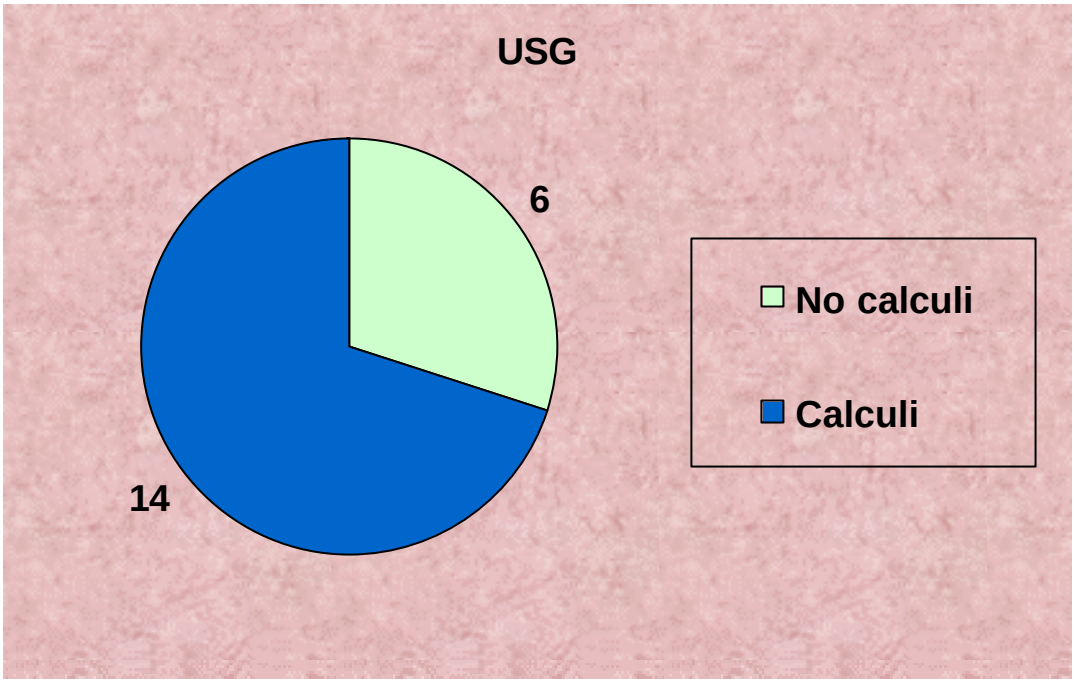
4 patients (E/H/L/R)– URS / Lithotripsy done

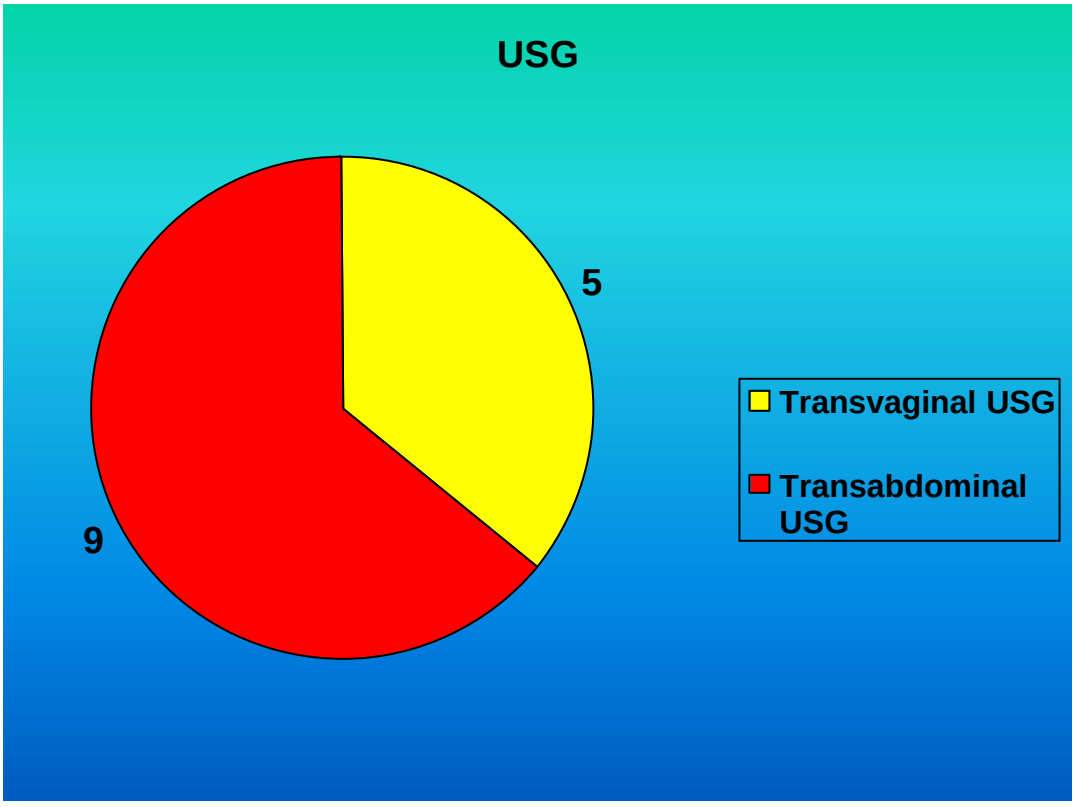
2 patients (A/D) – URS/Lithotripsy done due to stent related complication.

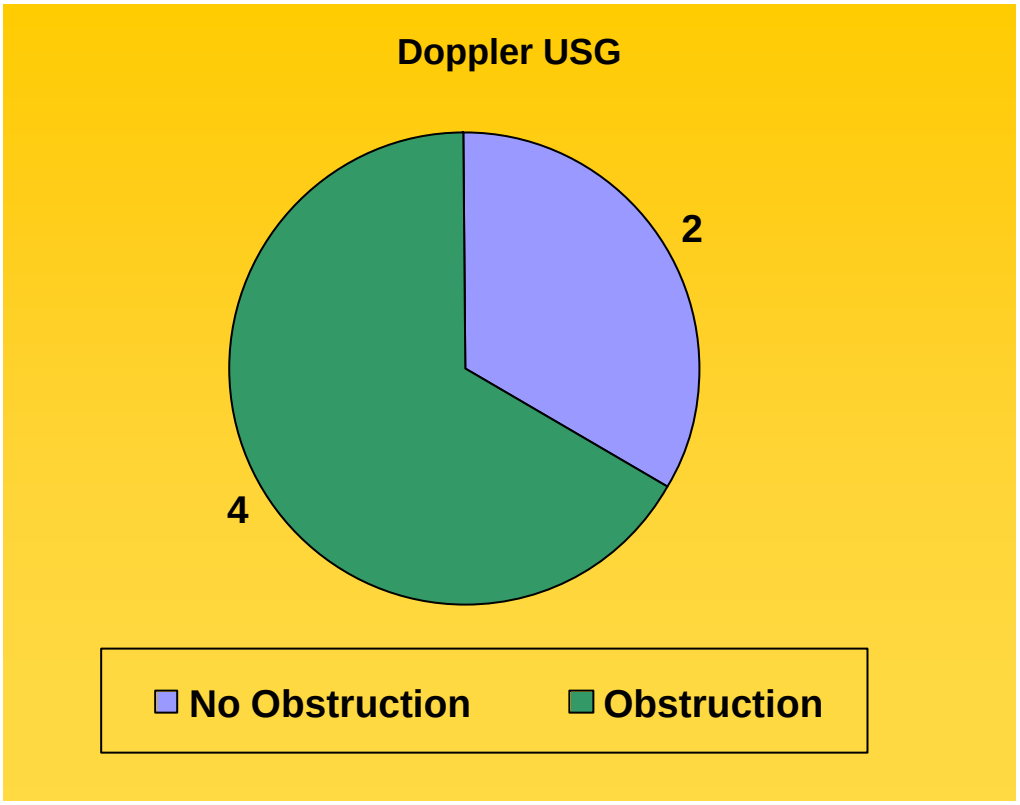
Patient A – stent encrustation within 3 weeks.

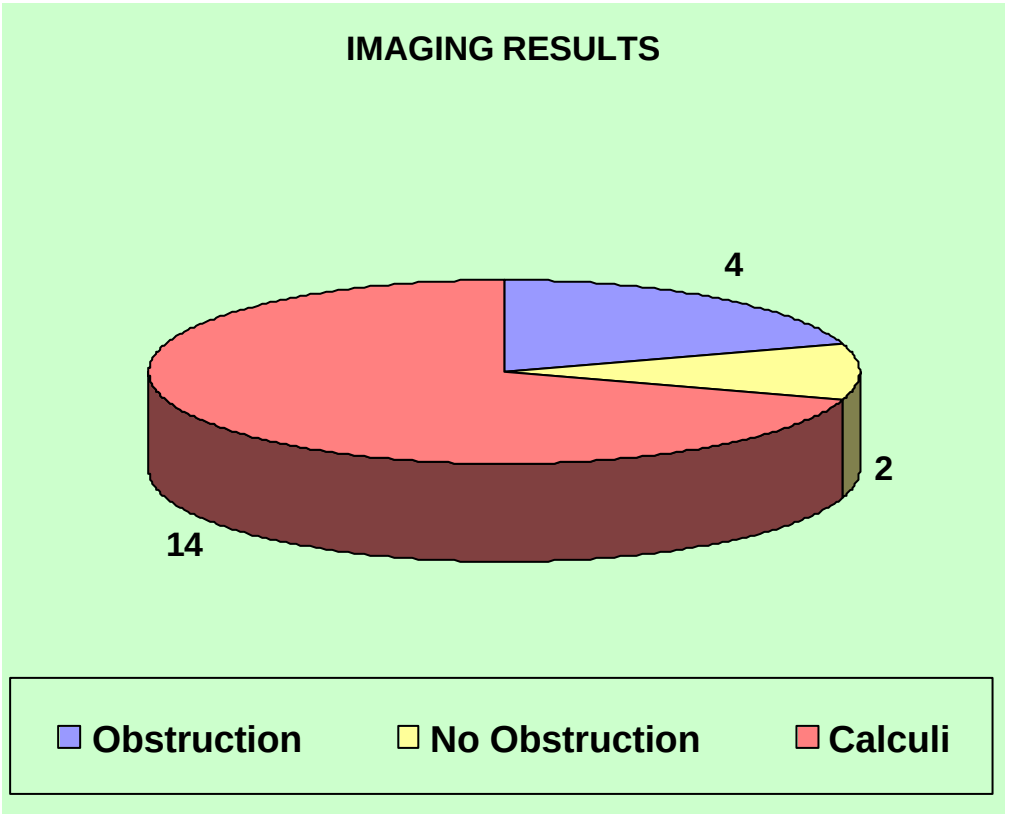
Patient D – stent expulsion

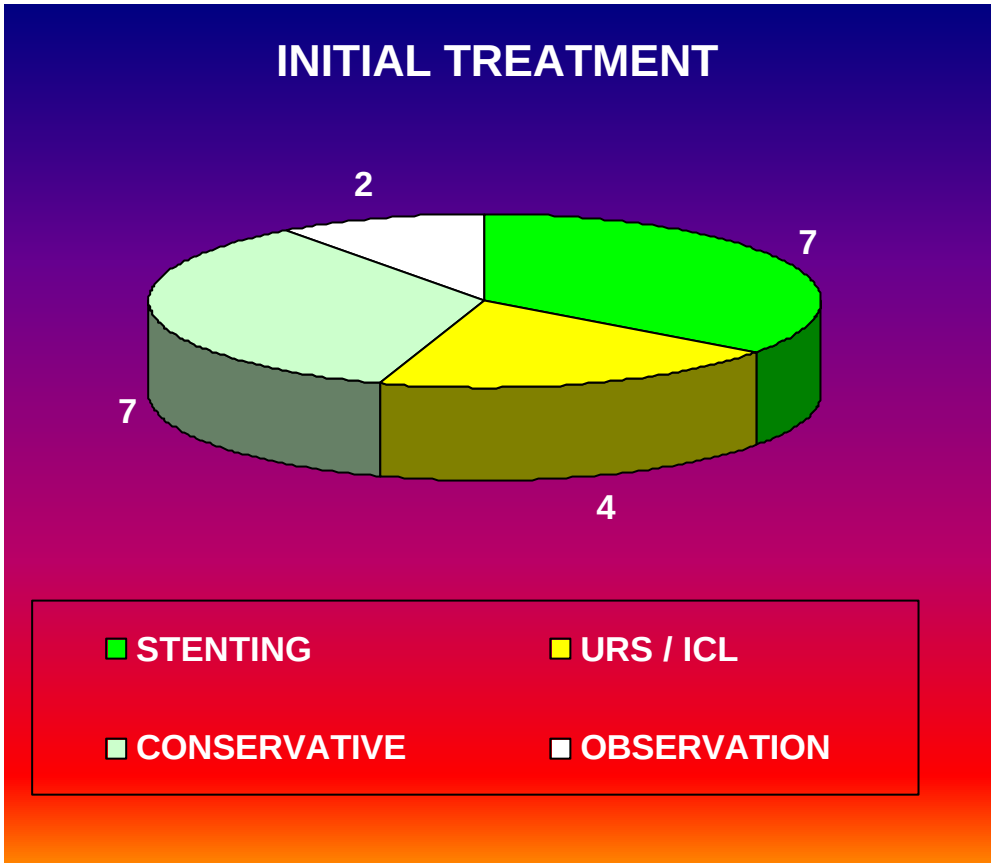
In all patients URS / Lithotripsy done in 2nd trimester under SA


USG
6
14
No calculi
Calculi

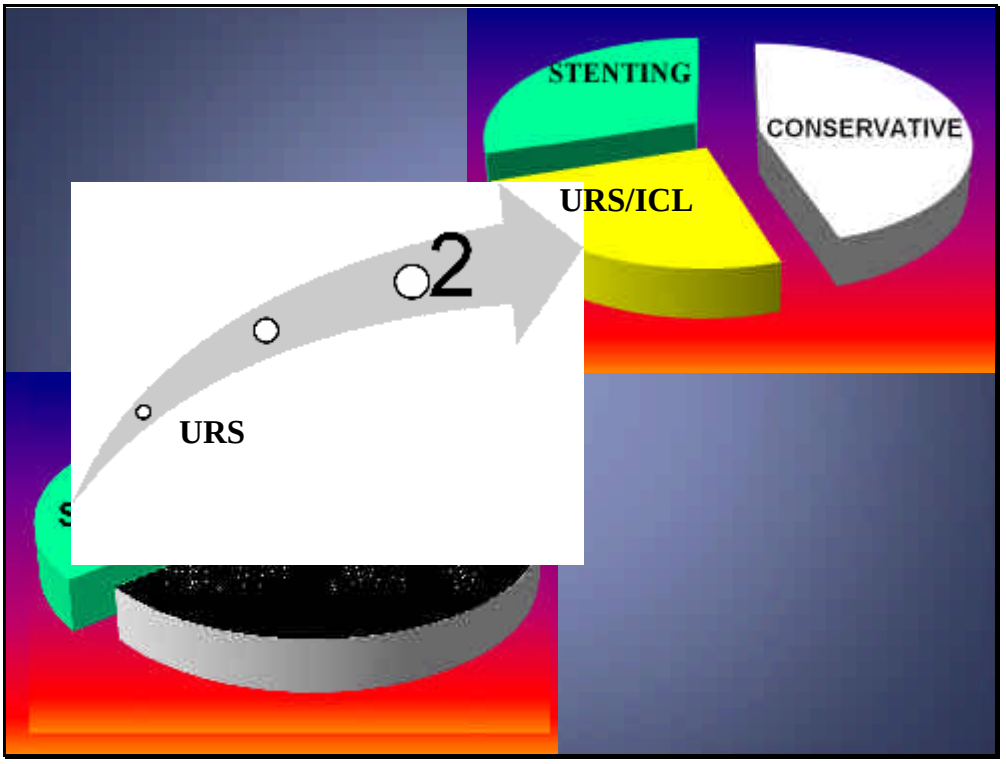

USG
5
9
Transvaginal USG
Transabdominal USG

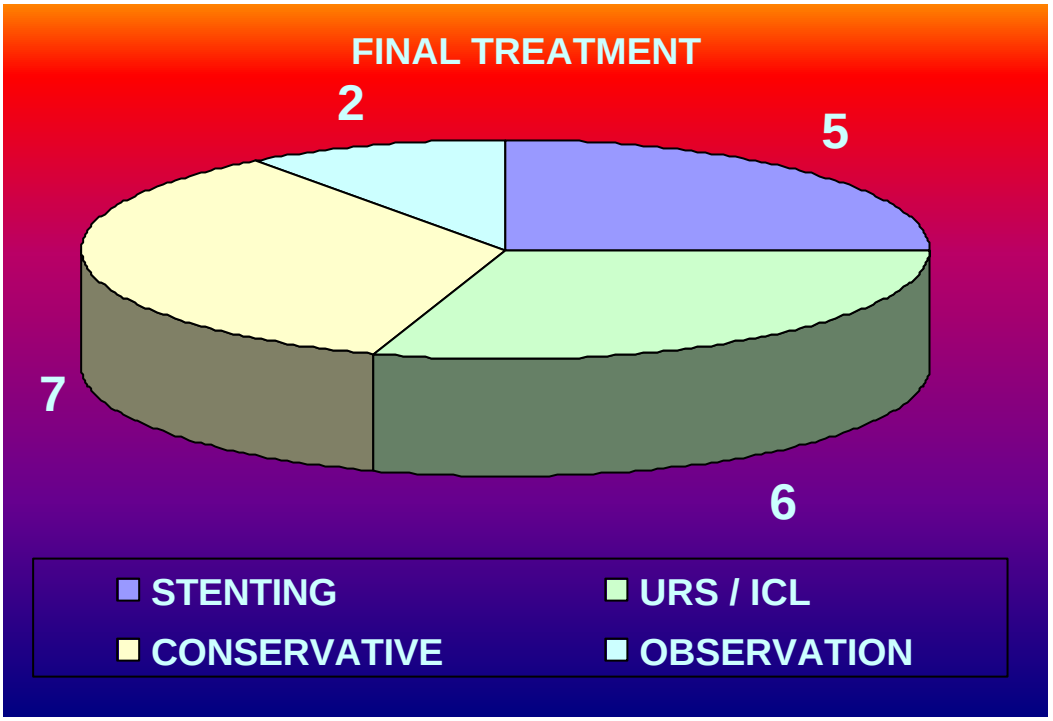

Doppler USG
2
4
No Obstruction
Obstruction

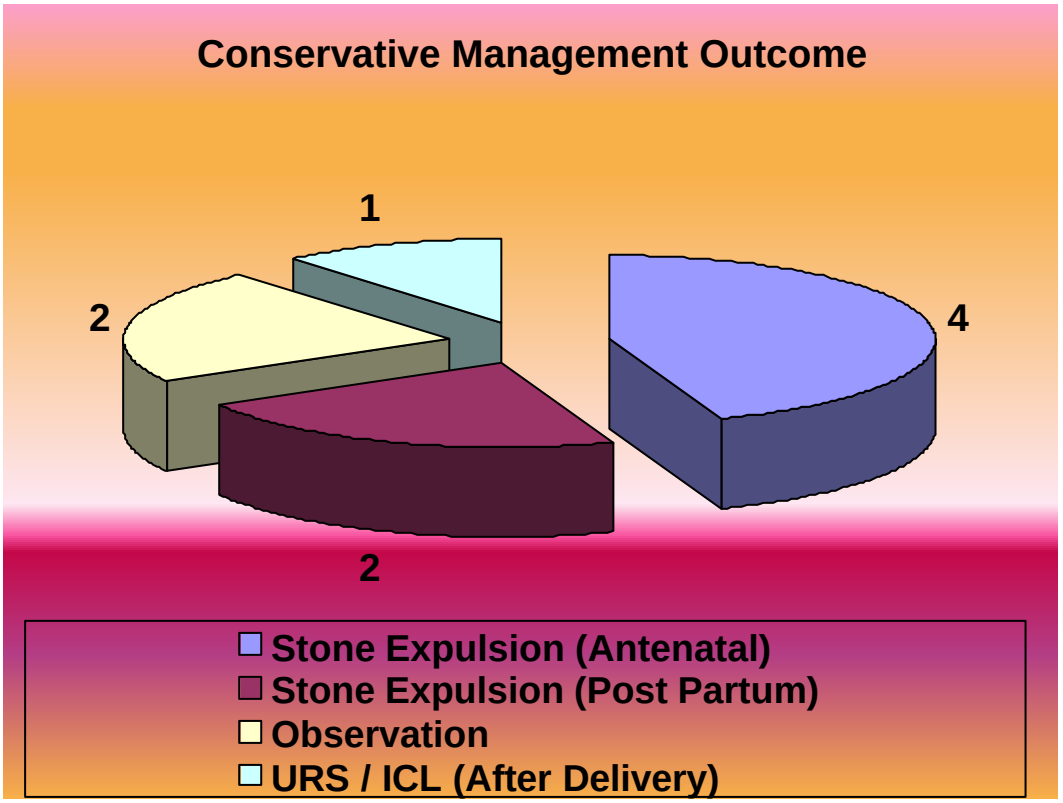

IMAGING RESULTS
4
2
14
Obstruction
No Obstruction
Calculi

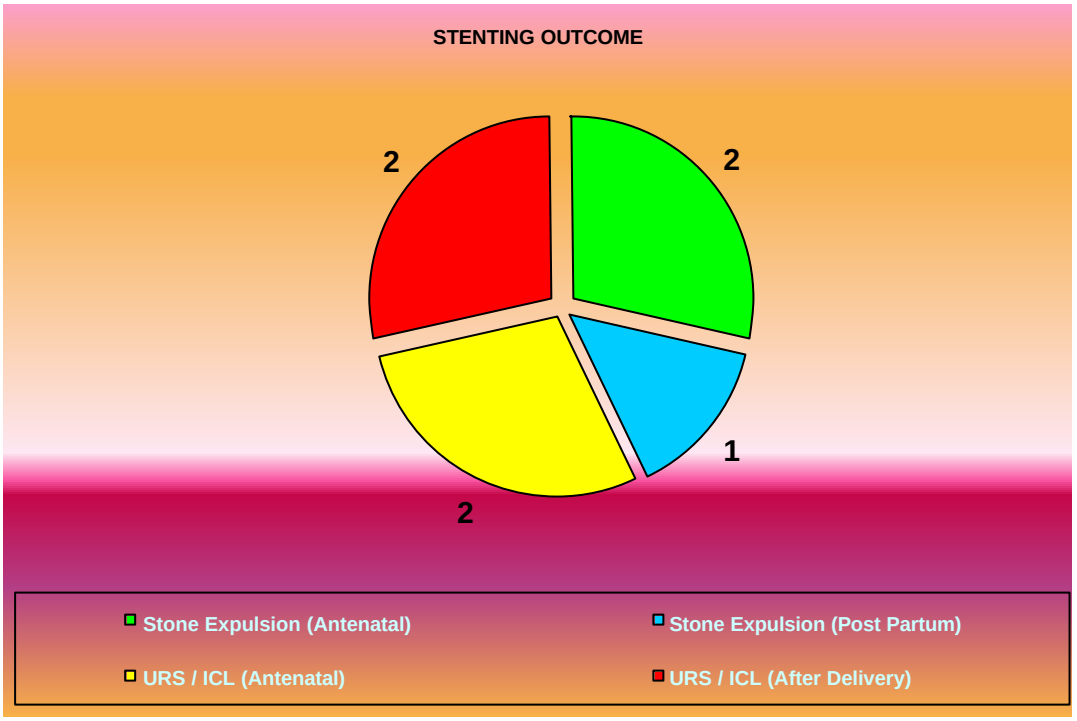

INITIAL TREATMENT
2
7
7
4
STENTING
URS / ICL
CONSERVATIVE
OBSERVATION

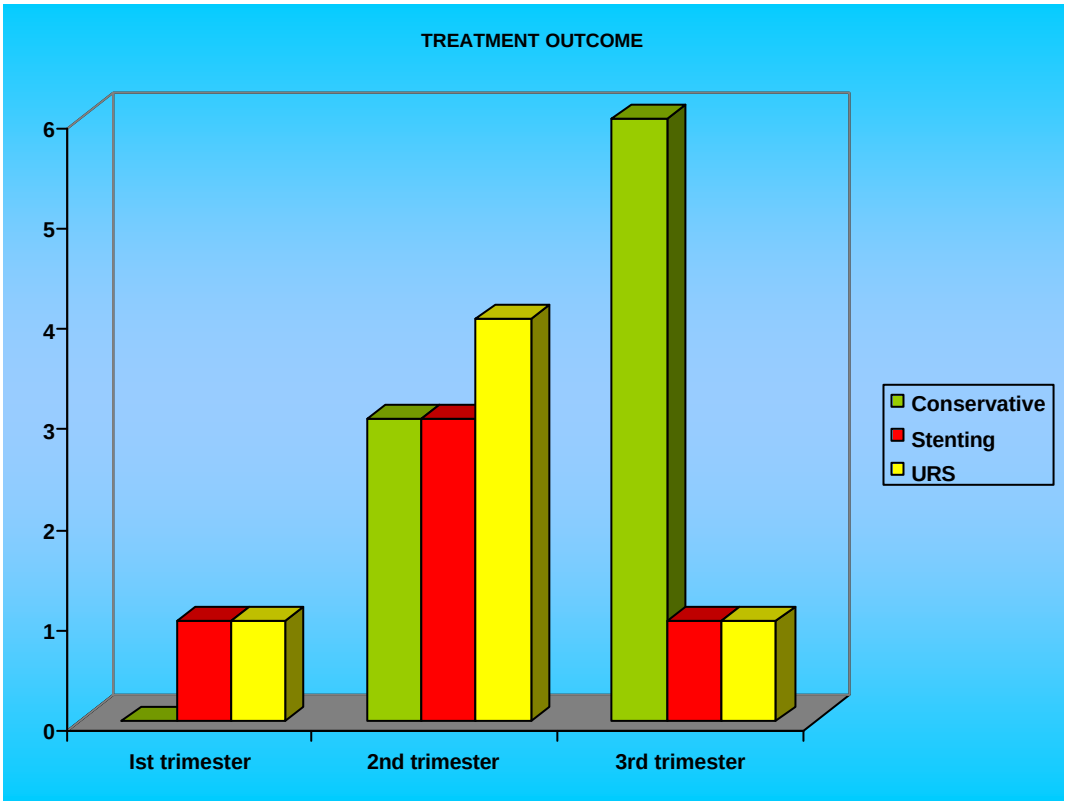
**TREATMENT**


STENTING
CONSERVATIVE
URS/ICL
2
URS


FINAL TREATMENT
2
5
7
6
STENTING
URS / ICL
CONSERVATIVE
OBSERVATION


Conservative Management Outcome
1
2
4
2
Stone Expulsion (Antenatal)
Stone Expulsion (Post Partum)
Observation
URS / ICL (After Delivery)


STENTING OUTCOME
2
2
1
2
Stone Expulsion (Antenatal)
Stone Expulsion (Post Partum)
URS / ICL (Antenatal)
URS / ICL (After Delivery)


TREATMENT OUTCOME
6
5
4
3
2
1
0
Ist trimester
2nd trimester
3rd trimester
Conservative
Stenting
URS

# DISCUSSION

**Clinical presentation :**

1. Study : Primi -14 patients

   Multigravida -6 patients

   Primi > Multi

   Literature : Adjusted for age – Primi = multi

2. Study : First : Second : Third trimester

   2 10 8

   Literature : Majority of patients with asymptomatic calculi present during second and third

   Trimester but rarely during first trimester. (Denstedt and Razvi n1992, Stothers and

   Lee 1992, Swansopn et al 1995).

3. Study : Right : Left

   13 : 7

   Literature : Calculi present in equal frequency on left and right sides (Stothers and Lee 1992, Parulkar et al 1998)

| | | | |
|---|---|---|---|
| 4. | Study | : | Commonest presentation is colicy pain followed by microscopic hamaturia 9 patients(45%) with evidence of UTI in 3 patients (15%) & past history of renal stones 3 patients (15%) |
| | Literature | : | The most common presenting symptom is pain usually accompanied by either macroscopic or microscopic hematuria and in some cases, urinary tract infection (Stothers and Lee 1992), and past history of stones 30%. |
| 5. | Study | : | In all 20 patients USG showed evidence of hydro uretero nephrosis.<br>In 9 distal ureteral stone patients showed evidence of ureteal dilation below pelvic brim. |
| | Literature | : | Physiological dilatation rarely observed distal to pelvic brim (Schulman and Herlinger 1975) |
| 6. | Study | : | 18/20 Transabdominal USG 9/20<br>False negative 9/20<br>4 patients Doppler USG showed evidence of obstruction |

5 patients calculus demonstrated by Transvaginal USG.

2 patients both transabdominal / transvaginal USG / Doppler USG – No calculus

Distal ureter calculus :

Transabdominal USG: 4

Transvaginal USG : 9

| Literature : | Sensitivity | Specificity |
|---|---|---|
| Stothers /Lee 1992 | 34% | 86% |
| Butler and associates 2000 | 60% | 80% |

Laing and associates (1994) identified distal ureteral stones in all 13 patients with transvaginal ultrasonography and 2 patients trans abdominal ultrasonography.

So transvaginal ultrasonography provide best imaging in distal uretral calculus.

**DOPPLER ULTRASONOGRAPHY**

Study : RI >0.7

Difference between affected and unaffected side 0.04

4 patients showed evidence of obstruction.

Literature : No ureteral jets on the suspected side obstruction

Ureteral obstruction can be diagnosed with sensitivity 100% and specificity 91% (Deyoe and associates)

There is variation in ureteral jet symmetry in later pregnancy and

Recommended use of this technique with caution (Burke and Washowich 1998) .

**TREATMENT**

**1. Conservative treatment**

All the patients were initially treated with conservative treatment-hydration, analgesics and antibiotics.

Conservative treatment – spontaneous passage of stones-6/7 patients.

Literature : Spontaneous passage with conservative treatment 64-84% (Parulkar 1998, Stothers 1992)

Study : Spontaneous passage -3 patients

**2. STENTING**

1. Cystoscopy /LA/USG
2. Stent
3. Stent changing every 12 weeks
4. Stent related complications

    1. stent encrustation within 3 weeks -2 patients

    2. stent expulsion -2 patients

**LITERATURE:**

1. Ureteral stents can be placed with LA under USG (Jarraid et al 1993, Loughlin 1994, Swanson et al 1995)

2. Accelerated encrustation and stent occlusion – common problem encountering optimal indwelling time for a ureteral stent in a pregnant patients not known Stent changing every 6-8 weeks (Karoussi and associates 1992)

3. Stent migration because of dilation (Stothers Lee 1992)

## 3. URS/ LITHOTRIPSY

Study : URS/ Lithotripsy done under SA

6 patients . No complication.

Literature : The definitive nature of one uncomplicated ureteroscopy

Probably represents less risk than the anaesthesia associated with multiple stent changes plus the infectious risk of an indwelling foreign body

i. Safe and successful use of flexible ureteroscopy (Rittenberg and Bagley 1988)

ii. Rigid URS for renal colic in pregnancy (Scarpo and associates 1996)

iii. Ureteroscopy used solely for diagnosis and removal of ureteric Calculi in pregnancy. (Lemos and coworker 2002)

iv. Ureteroscopy has been found to be safe and effective in all stages of Pregnancy.(Lifshitz 2002 , Watterson 2002, Scarpa1996, Ulrik 1995)

## 4. LITHOTRIPSY

Pneumatic lithotripsy -no complication

Literature :

1. Ultrasonic lithotripter should be avoided as high pitched audible sound may induce hearing injury in the fetus, although investigation in this area is ongoing and definitive data are not available.( Ulrik et al 1995, Karison et al 2001)

2. Electro hydraulic lithotripsy also to be avoided in pregnancy peak pressure generated by EHL are transmitted some distance from the probe, may harm the fetus and should be avoided in pregnancy (Volauther 1993)

3. If lithopripsy required , both Holmium: Yag Laser and pneumatic lithotrite devices are safe. Retrospective analysis of 8 patients who underwent ureteroscopy with Holmium :Yag laser lithotripsy . No obstetric or urologic complications occurred and the overall success rate of procedure was 91%.

## SHOCK WAVE LITHOTRIPSY

Literature:

- ESWL is contraindicated during pregnancy (Streen 1997)
- Animal studies have confirmed fetal death after exposture to SWL
- Although there have been reports of inadvertent treatment of pregnancy
- Patients with SWL , with no adverse squeale to the fetus. Pregnancy remains a contraindication to this treatment modalities (Chaussy and Fuchs 1989 , Frankenschmidt and Sommerkamp 1998)

## ANAESTHESIA

Study : Stenting under LA -5 patients

URS / Lithotripsy under SA – 6 patients

## DISCUSSION

Inhalation anaesthetics readily cross the placenta because of their solubility . These agents have been shown to increase risk of teratogenicity. General anaesthesia should be avoided during the first trimester, after which the risk is minimal (Biyani 2002).

Increased risk of spontaneous abortion during 1st and 2nd trimester in patients who have undergone GA for various procedures (Duncat et al 1986)

Regional anaesthesia – safe in 1st and 2nd trimester without increased risk of spontaneous abortion and developing anomaly.

# REVIEW OF LITERATURE

Urolithiasis is the most common cause of nonobstetrical abdominal pain that requires hospitalization among pregnant patients.The relative incidence and rate of recurrent calculi in pregnant patients (1 per 1500 pregnant patients) is similar to that in nonpregnant patients. Symptomatic stones are found in the ureter twice as often as in the renal pelvis and affect both ureters in equal frequency. Eighty to ninety percent are diagnosed after the first trimester.

Urolithiasis in pregnancy is often a diagnostic and therapeutic challenge for multiple reasons. Appendicitis, diverticulitis, or placental abruption was mistakenly diagnosed in 28% of patients in a 1992 study by Stothers and Lee.

Finally, most stones (64-84%) pass spontaneously with conservative treatment. However, if the calculus does not pass, it may initiate premature labor, produce intractable pain, cause urosepsis in the setting of urinary tract infection, or interfere with the progression of normal labor.

Of the various imaging modalities currently available, renal ultrasonography has become the first-line screening test for urolithiasis in pregnant patients, Treatment of stones in pregnancy ranges from conservative management (eg, bed rest, hydration, analgesia) to more

invasive measures (eg, stent placement, ureteroscopy with stone manipulation). With appropriate diagnosis and management, the outcome for both the mother and baby is excellent.

**Pathophysiology**

Although pregnancy-induced urinary stasis and hypercalcemia of pregnancy have been proposed as likely etiologic factors in urolithiasis, this has been disputed. Pregnancy-related events that tend to enhance stone formation include decreased ureteral peristalsis, physiological hydronephrosis, infection, and increased urinary calcium excretion. Augmented excretion of urolithiasis inhibitors, such as citrate, magnesium, and glycosaminoglycans, neutralize these phenomena in pregnant patients, who are no more likely to form urinary calculi than nonpregnant patients. Coincident to the increased hypercalciuria in pregnancy is an increase in total circulating blood volume, making the relative supersaturation of calcium insignificant.

**Anatomic and physiologic changes during pregnancy**

Hydroureteronephrosis is the most significant renal alteration during pregnancy. Physiologic dilatation of the collecting system begins in the first trimester at 6-10 weeks' gestation and persists until 4-6 weeks following delivery. Early theories suggest that hydronephrosis of pregnancy may be a hormonally induced phenomenon whereby ureteral

smooth muscles relax in response to high levels of circulating progesterone. In early pregnancy, increased progesterone secretion dilates the ureters and reduces ureteral peristalsis, causing hydronephrosis. Alternatively, the predominant theory ascribes ureteric dilatation to compression of the ureter by the enlarging gravid uterus at the level of the pelvic brim, where the ureter crosses the iliac vessels.

Dilatation is greater on the right side than on the left because of pressure due to physiologic engorgement of the right ovarian vein and dextrorotation of the uterus. Swanson and associates (1995) observed that hydroureteronephrosis was not routinely found below the pelvic brim and was altogether absent in patients who had undergone urinary diversion.

**Uric acid stone formation**

The formation of uric acid stones requires continued and excessive oversaturation of urine with uric acid or extreme aciduria. Dehydration, hyperuricosuria, and significantly acidic urine contribute to uric acid supersaturation and stone formation.

**Calcium oxalate and calcium phosphate stone formation**

In the pregnant patient, physiologic absorptive hypercalciuria is due to elevated levels of serum 1,25 dihydroxycholecalciferol (1,25

vitamin D). This hormone, which is secreted by the placenta, augments calcium absorption in the GI tract and suppresses parathormone production, increasing renal excretion of calcium. Additionally, dietary supplementation of calcium during gestation further augments calcium excretion.

**Struvite stones**

Struvite stones form only when the urinary tract is infected with urea-splitting organisms (eg, Proteus species). These infected stones are usually composed of pure magnesium ammonium phosphate but may be formed around a coexisting calcium, uric acid, or cystine stone. Struvite stones appear to develop more commonly in the presence of a congenital abnormality of the collecting system.

Approximately 80-90% of pregnant patients with urinary calculi present with symptoms during the second or third trimester because spontaneous stone passage is more difficult at this stage of pregnancy.

**Ureteral stones occur twice as often as kidney stones in pregnant patients.**

Approximately 64-84% of renal calculi pass spontaneously with conservative management, especially if they 4 mm or smaller. Stones

that are 7 mm or larger are much less likely to pass without intervention and often require some type of treatment.

Urinary stones in women usually manifest during the third to fifth decades of life, with an average age of 24.6 years. Urolithiasis occurs in pregnant women at rates similar to age-matched nonpregnant women.[5]

Urolithiasis presents as a diagnostic challenge. Clinical manifestations of urolithiasis in pregnant patients often resemble signs and symptoms of pregnant patients without stones, not to mention many other sources of abdominal pathology

Flank pain (89%) and hematuria (95%) are the most common symptoms of kidney stones Pregnant patients with ureteral stones may report pain in atypical locations or the pain of premature labor. Signs of premature labor, ectopic pregnancy, or complicated labor often mimic clinical symptoms of renal-ureteral calculi. Therefore, maintaining a high degree of suspicion in all pregnant women with abdominal or pelvic pain, hematuria (gross or microscopic), or unresolved urinary tract infections is imperative.

The most common symptoms of urolithiasis of pregnancy include the following:

a. Flank pain
b. Pain radiating to the groin or labia
c. Nausea
d. Dysuria
e. Gross hematuria

Patients with renal colic are often extremely restless, exhibiting active movement on presentation.

On inspection, the abdomen may be moderately distended, especially if the patient has coexisting ileus.

On palpation, the abdomen is soft and tender in the upper quadrant. This differs significantly from the motionless presentation and rigid abdomen of a patient with peritonitis.

On auscultation, bowel sounds do not provide helpful clues because they may range from hyperactive to markedly diminished because the patient may have concurrent ileus.

Other signs and symptoms include costovertebral angle tenderness, generalized flank tenderness, and voluntary guarding of the abdominal musculature.

**Causes**

Stone formation during pregnancy does not appear to have any etiologic factors that are unique to pregnancy. Risk factors associated with urolithiasis in general include the following:

- Heredity
- Age (third to fifth decades of life)
- Decreased water intake
- Increased environmental temperature and/or dry climate
- Diet (eg, high in calcium, sodium, and red meat consumption)
- Occupation (eg, exposure to hot climate)
- Geographic location
- Social class (related to occupation and diet)
- Excessive weight or obesity (apparently a risk factor in women but not in men)

**Laboratory Studies**

- Urinalysis - To assess for microscopic hematuria.
- The presence of red blood cells may suggest a calculus.
- Using both dipstick and microscopic analysis can identify microscopic hematuria in 95% of patients with urinary stones.
- Pyuria, which can result from an inflammatory reaction to a stone or infection, mandates evaluation of a coexisting urinary tract infection. Urinary tract infection is present in approximately 31%.
- Urine pH greater than 7 may signal the presence of infected stones (magnesium-ammonium-phosphate) with urea-splitting organisms (eg, Proteus and Klebsiella species).
- Acidic urine (pH <5) suggests the presence of a uric acid stone.
- Urine culture - To identify the offending bacteria and determine antibiotic sensitivities
- Complete blood cell (CBC) count - To determine the presence or absence of systemic infection

- Renal parameters

- Elevated serum creatinine levels suggest azotemia due to ureteral obstruction or chronic renal insufficiency. The physiologic increase in GFR during pregnancy dictates that the serum creatinine and BUN levels should be nearly 25% less than levels in the nonpregnant patient.

**Imaging Studies**

Renal ultrasonography, with or without Doppler studies, is recommended as the primary imaging modality in pregnant women. Renal ultrasonography is the first-line screening tool for urolithiasis in pregnant patients. Stothers and Lee (1992) found that renal ultrasonography provided a sensitivity of 34% and specificity of 86%, yet Parulkar et al (1998) reported 95% and 87%, respectively. The sonogram may not actually show the stone.

However, false-positive results may occur in the setting of extrarenal pelvis, vesicoureteral reflux, a high urine-flow rate, parapelvic cysts, and crossing vessels within the renal sinus. Up to 35% of patients with documented acute ureteral obstruction may not demonstrate any significant hydronephrosis, which makes standard ultrasonography less useful. Furthermore, differentiating hydronephrosis

caused by an obstructing calculus due to physiologic dilation of pregnancy may be difficult.

Advantages of renal ultrasonography include avoidance of radiation exposure to the fetus, no pain, avoidance of proallergenic intravenous contrast material, and the ability to examine coexisting abdominal or pelvic disease etiologies.

**Vaginal Ultrasonography:**

This has been found valuable in revealing stones in the distal ureter that are not visualized with renal ultrasonography. Laing et al (1994) reported that distal ureteral stones were identified in 13 of 13 patients; renal ultrasonography revealed the distal stones in only 15% of the 13 patients. Laing et al also observed that patients tolerated the procedure well. Loughlin and Ker (2002) endorse the use of a transrectal ultrasonography probe if a vaginal transducer is unavailable.

**Renal ultrasonography with Doppler sonography :**

In contrast to standard renal ultrasonography, ultrasonography with Doppler studies enables recording of waveform tracings of the renal vasculature. Ureteric obstruction increases renal vascular resistance, resulting in a reduction of diastolic blood flow and a rise in renal resistance.

Based on waveform tracings, a resistive index (RI) value is calculated (RI = peak systolic velocity - peak diastolic velocity / peak systolic velocity), providing improved sensitivity and specificity for differentiating obstructed from nonobstructed dilated collecting systems.

An elevated RI value of greater than 0.70 is specific for ureteral obstruction. Alternatively, a difference in the RI of 0.04 or more between the affected and contralateral kidney also suggests an obstruction in the side with the higher RI value.

Shokeir and Abdulmaaboud (1999) also evaluated the change in RI, which showed increased sensitivity (88%) and specificity (98%) in diagnosing ureteral obstruction.

Color Doppler renal sonography is a new addition to sonographic visualization of calculi, with a reported sensitivity of 100% and a specificity of 91% for diagnosing ureteral obstruction.

This important study demonstrates the presence of ureteral jets (streams of densely opacified urine) flowing into the bladder (containing dilute nonopacified urine). The absence of these jets may suggest ureteral obstruction, while symmetric jets indicate the absence of obstruction. In addition, color Doppler studies also aid in differentiating iliac vessels from a dilated ureter.

Equivocal sonographic results that do not suggest either physiologic hydronephrosis of pregnancy or urolithiasis require further imaging with limited excretory urography.

Normal findings on renal sonography are consistent with the following results:

Degree of renal and ureteral dilation consistent with pregnancy

RI value of less than 0.70 in both kidneys

Symmetric ureteral jets

No specific calculus identified

The following results indicate a high probability of urolithiasis during pregnancy:

Greater degree of dilatation disproportionate to hydronephrosis of pregnancy in collecting system

RI value greater than 0.70 in the symptomatic kidney or change in RI greater than 0.60

Dilated ureter extending below the level of the iliac arteries

Asymmetry of ureteral jets

Identification of calculus

## PROCEDURES

- **Ureteroscopy**

Ureteroscopy has emerged as a safe and efficient way to treat urolithiasis during pregnancy. Ulvik and associates (1995) have used ureteroscopy to successfully treat urolithiasis and consider it as a diagnostic procedure in difficult cases. Rigid or flexible ureteroscopes may be used, but Ulvik et al feel that flexible scopes may be better suited in diagnosis during pregnancy.

Rittenberg and Bagley reported the use of ureteroscopy for diagnosis with local anesthesia alone in 1988. Currently available ureteroscopes are small and may be used with minimal or no anesthesia. Lemos and coworkers (2002) feel that ureteroscopy used solely for diagnosis may be aggressive but agree that it can be used as a single modality for diagnosis and removal of ureteral calculi in pregnancy. Ureteroscopy offers clear-cut diagnosis, with direct visualization, as well as definitive therapy in the same encounter.

### Treatment

The initial management of urolithiasis in pregnancy should be conservative. Intravenous hydration and analgesia have been shown to result in spontaneous passage of symptomatic calculi in 64-84% of

patients. Bed rest, antiemetics, and antibiotics are also important, when indicated.

Some stones may simply become asymptomatic, allowing delay of further treatment. Symptomatic urolithiasis is more likely to resolve when calculi are located in the renal pelvis as opposed to the distal ureter.

Treatment goals in the remaining patients are to reduce maternal discomfort, to prevent renal damage and sepsis due to obstructing calculi, and to minimize risks to the fetus. If conservative measures fail to relieve clinical symptoms or to pass calculi, appropriate surgical intervention should be undertaken.

Several narcotics have been tested for use during pregnancy. Morphine sulfate, hydromorphone, butorphanol, meperidine, and acetaminophen provide temporary symptomatic relief without harming the fetus

Nonsteroidal anti-inflammatory drugs (NSAIDs) are also contraindicated because of an increased risk of miscarriage when used in the first trimester. In addition, fetal renal anomalies, fetal pulmonary hypertension, and premature closure of the ductus arteriosus are risks when NSAIDS are prescribed close to term.

**Surgical Care**

Surgical intervention is required in 20-30% of pregnancies complicated by urolithiasis. Surgical treatments are somewhat limited and are used to provide temporizing drainage of an obstructed system with placement of a ureteral stent to delay treatment until completion of the pregnancy, or to definitively diagnose and treat the stone with ureteroscopic methods.

A broad spectrum of interventions, ranging from ureteral stent placement to open lithotomy, have been used to successfully treat urolithiasis in pregnancy ; however, regardless of the mode or invasiveness of the surgical intervention (eg, endoscopic, percutaneous, open), each carries an element of risk to the mother and fetus.

Surgical intervention is reserved for pregnant patients in whom conservative management fails or when surgery is otherwise indicated. Admission of these patients by the obstetrician service for consultation with a urologist is not unusual. As a result, most if not all, of these women undergo noninvasive fetal monitoring.

- Indications for surgical intervention include the following:

  Ureteral obstruction associated with increasing azotemia

  Obstruction in a solitary kidney

  Intractable pain despite maximal conservative measures

  Urosepsis

  Renal colic–induced premature labor unresponsive to tocolytics

Traditional treatment has consisted of initial placement of a insertion of a ureteral stent for temporary drainage. Ureteral stents and/or nephrostomy tubes are then changed at periodic intervals until delivery, thus allowing delay of definitive treatment until completion of pregnancy.

Ureteroscopy is gaining favor as a first-line approach to urinary calculi that require intervention. Improved instruments and increased experience have led to successful outcomes with few complications.

Disbanding of supposed limitations (anatomical distortion late in pregnancy) and resolution of many associated concerns (anesthesia, radiation) has resulted in advocacy from previous opponents. These significant changes represent a paradigm shift in intervention for urolithiasis in pregnancy unresponsive to conservative treatment.

**Ureteral stent placement:** Internal stents are usually placed with ultrasound guidance or limited fluoroscopy with local anesthesia. This minimizes risks of radiation and anesthesia to the fetus. Increasing oral hydration and decreasing calcium intake is recommended to prevent stent encrustation secondary to urinary stasis, hypercalciuria, or infection.

Replacing stents every 3-4 weeks and antibiotic prophylaxis are suggested to avoid urinary tract infection and calcification. Insertion of percutaneous nephrostomy tubes or ureteral stents is considered a minor procedure, yet repeated insertions or changes may carry risks comparable with those of definitive ureteroscopy in a single setting. The obstetrician should be involved for fetal monitoring.

Ureteral stents often cause irritative voiding symptoms and chronic discomfort. The physiologic hydroureteronephrosis of pregnancy has been found to aggravate that by allowing more frequent stent migration within the dilated system.

Parulkar and coworkers (1998) studied a group of 70 pregnant patients with urolithiasis; 19 patients required intervention, 15 of whom had ureteral stents placed. They reported that 5 of 15 patients (>30%) required subsequent manipulation because of migration, encrustation, or severe irritative symptoms.

Denstedt and Razvi (1992) recommend limiting ureteral stent placement until after 22 weeks of pregnancy, with use of a percutaneous nephrostomy prior to that point. If a ureteral stent is indicated but cannot be placed with ultrasound guidance or if urosepsis is present, a percutaneous nephrostomy tube should be placed instead.

Disadvantages to internal ureteral stent include the following:

Urinary tract infections and promotion of ascending infections

Hematuria

Irritative voiding symptoms and renal colic due to stent

Stent migration due to hydroureteronephrosis of pregnancy

Multiple procedures to change stent to avoid encrustation

Need for patient compliance and vigilant follow-up for stent change

Ureteroscopy and stone manipulation: Ureteroscopy allows for complete visualization of the entire ureter and renal pelvis, enabling accurate diagnosis and definitive treatment for urolithiasis. Anatomic distortion near the completion of pregnancy has long been thought to make ureteroscopy impossible.

However, ureteroscopy has been found to be safe and effective in all stages of pregnancy. They also found that rigid ureteroscopy could be performed on the entire urinary tract, even in advanced pregnancy.

The above group of series, along with the work of Lemos and associates , represent 68 patients who underwent ureteroscopy for diagnosis and/or treatment; no obstetrical complications were reported, and only one ureteral perforation was reported. The one perforationwas treated successfully with a stent, and the child was born healthy at term.

Most ureteroscopies are performed in the absence of radiation. In the above studies, radiation was used sparingly in only a few patients; furthermore, Ulvik et al (1995) and Scarpa et al (1996) used no radiation. Physiologic hydroureteronephrosis of pregnancy allows entry of the ureteroscope under direct vision without dilation of the ureteral orifice; dilation is rarely performed.

General anesthesia is rarely used. The vast majority of procedures have been performed with epidural or spinal analgesia with an element of sedation. Scarpa and coworkers (1996) performed ureteroscopies in 5 patients without anesthesia and used only neuroleptic anesthesia (fentanyl or propofol and atropine) in 10.

Ulvik et al (1995) reports the use of sedation analgesia and feel that it may be preferred to spinal or general anesthesia. Both rigid and flexible scopes have been used successfully.

Kavoussi and associates (1998) suggest that definitive ureteroscopy may be preferable to stenting in select patients (particularly patients >6 wk prior to term) Ulvik and associates (1995) found a significant decrease in hospital stay among ureteroscopy patients (mean, 2.7 d) compared with ureteral stent patients (mean, 7 d) of Stothers and Lee (1992).

Stone retrieval via ureteroscopy has been performed successfully in many forms. These include holmium YAG Laser, pulsed dye laser, ballistic lithotriptor, ultrasonic lithotriptor, basket retrieval, and forceps crush and retrieval; all were used successfully without known complications.

The holmium YAG laser, with less than 1 mm of penetration, has been used most frequently in the more recent studies. Ulvik and coworkers (1995) recommended against the use of the ultrasonic lithotriptor until further data can prove its safety in fear that the high-pitched noise may result in hearing injury to the fetus.

Akpinar and associates (2006) presented the most recent experience of ureteroscopy in 7 patients. The holmium laser was used

with success in 6 patients and no stone was found in the seventh. They compared postoperative pain with or without a ureteral stent. They recommend routine stent placement with a string for 72 hours postoperation in order to reduce pain and analgesic requirements.

# CONCLUSION

- Urolithiasis remains a diagnostic and therapeutic challenge.
- High index of clinical suspision is necessary.
- While choosing the diagnostic / therapeutic modalities it must be 100% safe to mother and fetus.
- Goals of therapy must be
    - To keep the kidney functioning
    - Patients must be free of symptoms.
    - Not to disturb the ongoing pregnancy.
- Ultrasonography remains the cornerstone of imaging.
- Evaluation with Transvaginal USG to assess distal ureteric stone.
- Doppler USG can be used with full safety to detect obstruction (Indirect evidence of calculus )
- URS and Lithotripsy are :
    - Both Diagnostic / therapeutic are safe.
- As most stones will pass spontaneously , expectant management with supportive care should be attempted, but stenting and definitive ureteroscopy are highly successful if required .

- Although the expectant mother who has flank pain is often approached with trepidation , the combination of a high index of suspicion, careful regard for the mother and fetus and use of well established endo urologic techniques maximize the possibly of an excellent, stone free outcome.

# PROFORMA

Patients Name :

Age :

Sex :

Occupation :

Address :

Clinical symptoms :

Clinical signs :

Investigations :

Urine analysis

Urine culture & sensitivity

Renal parameters

Hemogram

USG abdomen

Trans vaginal USG

Color Doppler USG

Diagnosis :

Treatment :

Conservative

Stenting /LA

URS /ICL/SA

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# MASTER CHART

| S. No. | Name | Age | Sex | IP No/ PS No. | Knee / Elbow | Maturity of Scar | Scar - Hypertrophy | Duration of contracture | Degree of contracture | Days needed for correction | Complication | Recurrence | Associated deformating | Associated correction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | David Gunaseelan | 23 | M | 21649 | Elbow | Immature | + | 7 months | 30° | 32 | Scar Breakdown | + | HT Scar | - |
| 2 | Ramesh | 28 | M | 1746/08 | Elbow | Immature | + | 3 months | 30° | 14 | - | + | - | - |
| 3 | Latha | 23 | F | 24650 | Elbow | Immature | - | 2 months | 60° | 36 | - | - | PBC neck | Neck Contracture Release + SSG |
| 4 | Sathyanarayanan | 4 | M | 24613 | Elbow | Immature | - | 20 days | 80° | 28 | - | + | - | - |
| 5 | Kannagi | 34 | F | 23606 | Elbow | Immature | - | 3 months | 90° | 56 | - | + | - | - |
| 6 | Durga Devi | 15 | F | 17399 | Elbow | Immature | + | 4½ months | 30° | 21 | - | - | - | - |
| 7 | Jenifer | 22 | F | 17466 | Elbow | Immature | + | 4 months | 40° | 34 | Blister Superfical ulcer | - | HT Scar PBC Neck | - |
| 8 | Divya | 17 | F | 2179 | Elbow | Immature | + | 8 months | 60° | 48 | Blister | - | PBC neck | Neck Contracture Release + SSG |
| 9 | Alamelu | 24 | F | 2528 | Elbow | Immature | + | 10 months | 70° | 55 | - | - | PBC Left elbow | Left Elbow Contracture Release + SSG |
| 10 | Pachiammal | 27 | F | 2898 | Elbow | Immature | + | 3 months | 40° | 30 | - | - | PBC neck HT Scar Microstomia | Neck Contracture Release + SSG |
| 11 | Vijayababu | 25 | M | 21931 | Elbow | Immature | + | 4 months | 80° | 68 | Blister Superfical ulcer | + | PBC both axilla and hand, HT Scar | 1) Axillary Contracture release + Z plasty 2) Hand Contracture release + SSG |
| 12 | Kamatchi | 18 | F | 3519 | Elbow | Immature | + | 4 months | 30° | 24 | - | - | - | - |
| 13 | Sathya | 26 | F | 1038/08 | Elbow | Immature | + | 7 months | 70° | 52 | - | - | PBC (L) elbow, PBRA (L) Forearm | - |
| 14 | Sumathi | 20 | F | 99/09 | Elbow | Immature | + | 3 months | 60° | 42 | - | - | - | - |
| 15 | Vijayalakshmi | 27 | F | 27188 | Elbow | Immature | - | 2½ months | 40° | 14 | - | - | PBRA (R) Forearm | SSG |
| 16 | Mohanraj | 36 | M | 185/05 | Elbow | Immature | + | 2 months | 30° | 23 | - | - | PBC (R) Axilla, (R) elbow, HT scar | Right Axillary Contracture release + SSG |
| 17 | Kasthuri | 44 | F | 22980 | Elbow | Immature | + | 5 months | 20° | 14 | - | - | Eversion of Lower Lip | Eversion of lower lip correction with SSG |
| 18 | Chandra | 30 | F | 21842 | Elbow | Immature | + | 5 months | 80° | 60 | Blister Superfical ulcer | - | PBC (R) elbow | Right Elbow contracture Release + SSG |
| 19 | Radha | 23 | F | 6477 | Elbow | Immature | + | 7 months | 90° | 70 | Blister | + | PBC (R) elbow | Right Elbow contracture Release + SSG |
| 20 | Dinesh | 7 | M | 21680 | Knee | Immature | + | 2 months | 90° | 72 | - | + | HT scar, Interthigh adhesion, Mental Retardation | - |
| 21 | Marianisha | 10 | F | 25489 | Knee | Immature | + | 5 months | 40° | 36 | Blister | + | PBRA (R) Leg | SSG |
| 22 | Maheswari | 20 | F | 5428 | Knee | Immature | + | 2 months | 60° | 46 | Blister | - | HT Scar, PBC (L) Hip | - |
| 23 | Gunamangai | 6 | F | 6475 | Knee | Immature | + | 5½ months | 30° | 35 | Scar Breakdown | - | PBC Right Hand, alopecia | Contracture Release Right hand + SSG |