Management of Acute

Calcular Anuria in infants and children Aged Less than 5 Years

Thesis

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List of abbreviations

Abbreviation	Stand for what
g	Gram
PTH	Parathyroid hormone
PKa	Dissociation constant
Cr Cl	Creatinine clearance
AKI	Acute kidney injury
ATN	Acute tubular necrosis
AIN	Acute interstitial nephritis
BUO	Bilateral ureteric obstruction
UUO	Unilateral ureteric obstruction
CT UT	Non contrast spiral CT Scan on the urinary tract
RBF	Renal blood flow
GFR	Glomerular filtration rate
PAF	Platelet activating factor
TXA2	Thromboxane A 2
PCNL	Percutaneous nephrolithotomy
URS	Ureteroscopy
RTA	Renal tubular acidosis
RPGN	Rapidly progressive glomerulonephritis
NO	Nitric oxide
UVI	Uretero -vesical re implantation

Tables and figures

Abstract

Aim: to compare the effect and complications of sublingual versus vaginal administration of misoprostol for pre-operative cervical priming before surgical evacuation of pregnancy in first trimesteric missed abortions.

Material and Methods: 80 women diagnosed with first trimesteric missed abortion were randomized into either sublingual or vaginal groups of 40 each. They were given 400 μg misoprostol via sublingual or vaginal route for cervical priming 4 hours before the procedure. The outcome measures assessed were cervical dilatation (1ry) before surgery, duration of procedure, intraoperative blood loss, post abortive Et by U/S, post abortive bleeding and preoperative side effects.

Results: Subjects in the sublingual group achieved significantly higher mean cervical dilatation compared to vaginal group (8.63 ± 1.58 mm vs. 7.62 ± 2.22 mm, p = 0.03). The mean duration of procedure for sublingual group was significantly lower compared to the vaginal group (4.7 ± 1.87 minutes vs. 5.65 ± 2.48 minutes, p = 0.01). The intraoperative blood loss in both groups was found to be of no statistically significant difference same for post abortive bleeding. There was no statistically significant difference between both groups as regard ET by U/S. The sublingual group experienced more nausea and vomiting as compared to vaginal group. The vaginal group experienced more tachycardia and abdominal pain, which were statistically insignificant differences.

Conclusions: Sublingual misoprostol is more effective and convenient route than vaginal misoprostol for preoperative cervical priming in first trimester abortion.

Key words: Sublingual, Vaginal, Misoprostol, 1sttrimesteric, missed abortion, surgical evacuation, cervical primin

Anatomy Of The Urinary Tract

Kidneys:

Gross and Microscopic Anatomy:

Grossly, the kidneys are bilaterally paired brownish organs. Typically each kidney weighs 150 gram in the adult male and 135 gram in the adult female. The kidneys generally measure (in adults)10 to 12 cm in vertical dimension, 5 to 7 cm in medio-lateral dimension, and 3 cm in the anteroposterior dimension. The right kidney tends to be shorter and wider because of compression by the liver, in children; the kidneys are relatively larger and have more prominent fetal lobulations. These lobulations are present at time of birth and generally disappear by the first year of life, although occasionally they persist into adulthood. This is a normal variation without pathologic significance. As one proceeds centrally from the peripherally located reddish brown parenchyma of the kidney, the renal sinus is encountered. Here the vascular structures and collecting system coalesce before exiting the kidney medially. These structures are surrounded by sinus which is formed of yellow fat, at its medial border, the renal sinus narrows to form the renal hilum. At the hilum the structures are arranged as the following from anterior to posterior as the following: renal vein, renal artery and the renal pelvis .

The renal parenchyma can be divided into two portions the medulla and the cortex. The renal medulla is composed of renal pyramids which is multiple, distinct, conically shaped structures and notably darker in color than the cortex.the apex of the pyramid is the renal papilla, and each papilla is cupped by an individual minor calyx ***(Anderson et al,2007)***.

The renal cortex is lighter in color than the medulla and reaches between the pyramids themselves. These extensions of cortex between the renal pyramids are called the columns of Bertini. These columns are significant surgically because through these columns the renal vessels traverse from the renal sinus to the peripheral cortex, decreasing in diameter as the columns move peripherally. Because of this anatomy the percutaneous

access to the collecting system is made through a renal pyramid into a calyx, thus avoiding the columns of Bertini and the larger vessels present within them ***(Strandring et al,2008)***.

Relations and Investing Fascia:

Kidneys are retro peritoneal structures that vary greatly body position by side, presence of anatomic anomalies, and degree of inspiration. The right kidney is 1 to 2 cm lower than the left in most individuals due to displacement by the liver. Generally, the right kidney lies in the space between the upper edge of the first lumbar vertebra to the lower edge of the third lumbar vertebra. The left kidney occupies a more superior space from the body of the 12th thoracic vertebral body to the third lumbar vertebra.

Both kidneys have similar surrounding muscles: Posteriorly, the diaphragm covers the upper third of each kidney, with the last rib crossing at the lower extent of the diaphragm.

Medially the lower two thirds of the kidney lie on the psoas muscle, and laterally the quadratus lumborum and aponeurosis of the transversus abdominis muscles lie. The effect of the muscular relations on the kidneys is great on the position of the kidneys. The lower poles of the kidneys lie laterally and anteriorly relative to the upper pole. Also the medial aspect of each kidney is rotated anteriorly at an angle of approximately 30 degrees. An awareness of this renal position is of particular benefit for percutaneous renal procedures in which the position of the kidney affects access site selection.

Anterior relations of the right kidney include the liver and the hepatic flexure of the colon.

Anterior relations of the left kidney include the left kidney the posterior gastric wall and the splenic flexure of the colon.

Gerota's Fascia is interposed between the kidney and its surrounding structures. This fascial layer encompasses the peri renal fat and kidney and encloses the kidney on three sides: superiorly, medially, and laterally. Superiorly and laterally Gerota's fascia is closed, but medially it extends across the midline to fuse with the opposite side. Inferiorly, Gerota's fascia remains an open potential space ***(Anderson et al, 2007)***.

Renal Collecting System:

Renal collecting system is formed of, the pelvis, calyces, and renal papillae .The renal papillae are the tip of a medullary pyramid and constitute the first gross structure of the renal collecting system. Almost, there are 7 to 9 papillae in each kidney. Each of these papillae is cupped by a minor calyx. At the upper and lower poles, the calyces are compound. These compound calyces are the result of renal pyramid fusion and so are more likely to allow reflux into the renal parenchyma. After cupping individual papillae, each minor calyx narrows to an infundibulum .Infundibuli combine to form two or three major calyceal branches. These are frequently termed the upper, middle, and lower pole calyces, and these calyces combine to form the renal pelvis. The renal pelvis itself can vary greatly in size, and it may be intrarenal pelvis or extra renal pelvis. Eventually the pelvis narrows to form the ureteropelvic junction, marking the beginning of the ureter ***(Davies et al,2001)***

Anatomy of the ureters

Abdominal ureter:

The ureter is divided into abdominal and pelvic portions by the common iliac artery. Intraoperatively, the ureter is identified by its peristaltic waves and is readily crossing anterior to the bifurcation of the common iliac artery. At ureteroscopy, pulsations of this artery can be seen in the posterior ureteral wall.

Grossly the ureters are bilateral tubular structures that transport the urine from the renal pelvis to the bladder and they are generally variable in length according to the age of the child ***(Anderson et al, 2007)***.

Microscopically the ureteral wall composed of multiple layers. The inner layer is transitional epithelium. Followed by lamina propria. This is a connective tissue layer that along with the epithelium makes up the mucosal lining. Overlying the lamina propria is a layer of smooth muscle that is contiguous with muscle covering the renal calyces and pelvis, this muscle layer is formed of an inner longitudinal and an outer circular layer. Together, these muscular layers provide the peristaltic wave that actively transports urine from the renal collecting system through the ureter to the bladder. The outermost layer is the adventitia. This thin layer surrounds the ureter and contains the blood vessels and lymphatics of the ureter.

Pelvic Ureter

The ureters come within 5 cm of each other as they cross the iliac vessels. On entering the pelvis, they diverge widely along the pelvic side walls toward the ischial spines. The ureter travels on the anterior surface of the internal iliac vessels and is related laterally to the branches of the anterior trunk. Near the ischial spine, the ureter turns anteriorly and medially to reach the bladder. Where it pierces the bladder wall obliquely, travels 1.5 to 2 cm, and terminates at the ureteral orifice .

Important relations of the ureter

The ureter begins at the ureteropelvic junction, which lies posterior to the renal artery and vein in the hilum. It then progresses inferiorly along the anterior aspect of the psoas muscle. The right ureter is related anteriorly to the ascending colon, cecum, colonic mesentery, and appendix. The left ureter is closely related to the descending and sigmoid colon and their accompanying mesenteries. Approximately a third of the way to the bladder the ureter is crossed anteriorly by the gonadal vessels. As it enters the pelvis

the ureter crosses anterior to the bifurcation of iliac vessels .in the female pelvis, the ureters are crossed anteriorly by the uterine arteries and are closely related to the uterine cervix ***(Strandring et al,2008)***.

Three distinct narrowings classically described: the ureteropelvic junction, crossing of the iliac vessels at the entry of the pelvis, and the ureterovesical junction. These three sites of ureteral narrowing are clinically significant because they are common locations for urinary calculi to impact during passage. In addition, the angulation of the ureter, first anteriorly as it passes over the iliac vessels, then posteromedially as it enters the pelvis and courses behind the bladder, may restrict successful passage of rigid endoscopes. Appreciation of this normal angulation and the three-dimensional course of the ureter are critical for safe and successful ureteral endoscopy. The ureter can be divided into upper, middle, and lower segments. The upper ureter extends from the renal pelvis to the upper border of the sacrum. The middle ureter comprises the segment from the upper to the lower border of the sacrum. The lower ureter extends from the lower border of the sacrum to the bladder ***(Anderson et al, 2007)***.

Ureteral Blood Supply and Lymphatic Drainage:

Multiple arterial branches along the course of the ureter can supply it, of greatest importance to the surgeon is that arterial branches to the abdominal ureter approach from a medial direction whereas arterial branches to the pelvic ureter approach from a lateral direction. For the upper ureter these branches originate from the renal artery, gonadal artery, abdominal aorta, and common iliac artery. After entering the pelvis, additional small arterial branches to the distal ureter may arise from the internal iliac artery or its branches, especially the vesical and uterine arteries, but also from the middle rectal and vaginal arteries.The venous and lymphatic drainage of the ureter parallels the arterial supply. Thus, ureteral lymphatic drainage varies by ureteral level. In the pelvis, ureteral lymphatics drain to internal, external, and common iliac lymph nodes. In the abdomen, the left para-aortic lymph nodes are the primary drainage site for the left ureter whereas the abdominal portion of the right ureter is drained primarily to right paracaval and interaortocaval lymph nodes. The lymphatic drainage of the upper ureter and renal pelvis join

the renal lymphatics and is identical to that of the ipsilateral kidney ***(Strandring et al,2008)***.

Bladder

The bladder assumes an ovoid shape when it is completely full. The empty bladder is tetrahedral and is described as having a superior surface with an apex at the urachus, two inferolateral surfaces, and a posteroinferior surface or base with the bladder neck at the lowest part ***(Benningoff, 1993).***

Interior of the bladder (cystoscopic appearance of urinary bladder):

Trigone of the bladder

The internal urethral orifice and both orifices of the ureters form the boundaries of the trigone of the bladder. The interureteric ridge is a mucosal fold between the orifices of the ureters and helps to identify the orifices during transurethral cystoscopy. The wall of the bladder trigone consists of three layers:

Ureter and the superficial bladder trigone:

The ureter enters obliquely through the bladder wall (for short distance about 1.5 cm). The inner smooth muscle layer of the ureter forms with the inner smooth muscle layer of the contralateral ureter the superficial trigone which extends into the prostatic urethra till the veromontanum in men and to the external urethral orifice in women. Thus, the superficial bladder trigone is a tubular structure above the orifices of the ureter, and a flat structure below the orifices.

Waldeyer Sheath and the deep trigone bladder:

A separate external smooth muscle layer (Waldeyer's Sheath) accompanies the distal ureter to the bladder. After passing through the bladder wall, the Waldeyer's Sheath forms with fibers of the detrusor muscle the deep trigone of the bladder. these muscle fibers range from two orifices of the ureter to the bladder neck*.*

Detrusor muscle of the bladder:

The inner longitudinal layer of the bladder extends into the urethra in women until the external urethral meatus and in male until the caudal end of the prostate. The middle circularly arranged layer and the outer longitudinal layer extend to the bladder neck. In women, they surround the urethra and support the external urinary sphincter. The detrusor muscle is innervated by parasympathetic nerves (S2–S4) .

Vesico-ureteric junction integrety: the integrity of vesico-ureteric junction depends on 3 factors:

1-The contraction of the trigone pulls the orifices of the ureters caudal to the bladder neck. This results in a strong increase of the uretero-vesical resistance. The dysfunction of the trigone (transection, lumbar sympathectomy) may lead to vesicoureteral reflux.

2-The contraction of the trigone reduces the resistance of the bladder neck, thus decreasing resistance to urine flow.

3-The rise of vesical pressure during bladder filling and voiding also compresses the ureters due to the oblique passage through the bladder wall and prevent vesico-ureteric reflux.

(Benninghoff, 1993).

Anatomy of the male urethra:

Male Urethra:

The male urethra can be divided into the following parts:

Prostatic urethra: The veromontanum is located in the distal end of the prostatic urethra. At the verumontanum, end the ejaculatory ducts and pass into the urethra. The prostatic utricle is a remnant of the embryonic period (Müllerian duct) in the midline of the prostatic urethra. Its length 2-3 cm.

Membranous urethra: runs through the pelvic floor and is surrounded by the external urethral sphincter.

Spongy urethra: formed of the bulbar and penile urethra. Its length is about 15 cm. The Cowper's glands flow into the proximal spongy urethra. The urethral glands (Littre's glands) open on the entire length of the urethra.

Fossa navicularis: Dilated part of penile urethra while transversing the glans.***(porst et al, 2004)***.

Anatomy of the female urethra:

The female urethra is short (4 cm long) and empties at the vulva 2–3 cm posterior to the clitoris (external urethral meatus)The external sphincter muscle is located at the proximal portion of the urethra. The lumen of the proximal female urethra is lined with transitional epithelium. In the middle there is columnar epithelium and the distal urethra is lined with stratified squamous epithelium. ***(porst et al, 2004)***.

Endoscopic anatomy of the urinary tract

The trigone is raised, smooth triangular area lies just inside the bladder neck which its apex lies at the bladder neck and its base is the interureteric ridge which extends between the two ureteral orifices.It is the most vascular part of the bladder, and therefore it appears more deeply colored than the rest of the bladder. It is formed by an extension of the longitudinal muscle fibers of the ureters superimposed over the detrusor muscle .

The interureteric ridge is more prominent in males than females; but it can be found in almost all bladders .

The ureteral orifices are usually symmetrically located along this ridge, 1 to 2 cm from the midline .

The normal orifice may have the configuration described as a volcano, a horse-shoe, or some other configuration. It might be prominent and obvious on endoscopy, or appears as an inconspicuous slit that can be seen only on close examination .

When the bladder became full, the orifices are displaced laterally and the intravesical ureter is compressed, making identification of ureteral orifices more difficult. The ureteral orifice can be graded according to its configuration: grade 0 which is the normal cone or volcano orifice; grade 1 in which it appears like the stadium orifice; grade 2, in which it looks like the horseshoe orifice; and grade 3, the golf-hole orifice. These configurations were associated with an increasing tendency to lateral displacement and reflux as the grade progresses.

The intravesical part of the ureter extends for about 1.5cm from the ureteral orifice. First, the submucosal part courses posterolaterally in the bladder for a distance of about 0.5cm, then it runs obliquely through the bladder musculature at the detrusor hiatus for about 1 cm. It represents the narrowest part of the ureter. And it is requires dilation before introduction of large-caliber instruments. Furthermore there are other two naturally narrow sites within the lumen.which lie at the pelvic brim and the ureteropelvic

junction. These are relatively wider and are sufficiently dilated with irrigating fluid pressure to allow passage of instrument. These areas are identified endoscopically by a slightly stenotic appearance and relative nondistensibility. Furthermore, the pelvic brim constriction is at the area of the iliac vessels, which can be seen pulsating behind the ureter as this level is approached.

Following this is a relatively straight part where the middle of the ureter lies on the psoas muscle. It is here that the typical stellate appearance of the nondistended ureteral lumen can be seen. This leads to the third constriction at the ureteropelvic junction, which is identified endoscopically as a narrowing in the ureter leads to wide renal pelvis .

The kidney is a mobile structure that moves up and down with respiration. This movement is readily apparent endoscopically, because the ureteropelvic region is approached from the relatively fixed ureter. The peristaltic contractions of the ureter, along with the opening and closing of the ureteropelvic junction, can also be observed endoscopically.As the kidney lies posteriorly, the proximal aspect of the ureter passes posteriorly and laterally over the psoas muscle to enter the renal pelvis .

The normal renal pelvis is usually conical on shape, with the apex of the cone leading to the ureteropelvic junction. It may also be more box shaped, with the ureteropelvic junction near the lower medial angle.

The intrarenal pelvis is often small with short major calices while the extrarenal pelvis, on the other hand, is usually large, and because it lies outside the renal sinus, the major caliceal infundibula are by necessity long.

As the ureteroscope enters the renal pelvis, the ostia of the major calices are the first structures to be seen are. These are circular openings with carinae separating the individual calices. A long tubular infundibulum connects each ostium to the apex of the major calix, which then branches into the minor calices. These are the next structures visible as the ureteroscope enters the infundibulum.The ureteroinfundibular angle represents the angle of deflection necessary for a flexible ureteroscope to move from the axis of the upper section of the ureter to the axis of the lower infundibulum. This was