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Role of USG and MDCT in the Evaluation of Pelvic Pain in Women of Reproductive Age Group

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1. Introduction

Acute pelvic and/or lower abdominal pain in nonpregnant women of reproductive age is an extremely common presentation to emergency departments, urgent care centers and outpatient office practices. Approximately 1.4 million gynecologic visits were made to emergency departments annually, for an average annual rate of 24.3 visits per 100 women between the ages 15 to 44 years. Acute pelvic pain generally implies pain that is of less than 3 months duration in a toxic, ill appearing and unstable patient, or chronic pain that is worsening. When a female in the reproductive age presents with acute pelvic and/or lower abdominal pain, the first diagnoses to consider are those that are life threatening and would require urgent and/or emergent surgical intervention. Because the differential diagnosis of acute pelvic pain in the nonpregnant female of reproductive age includes many different organ systems (i.e. gastrointestinal, gynecological, urological, vascular, etc.) a cost-effective and efficient strategy, such a ultrasound need to be employed. It is essential in the assessment of pelvic pain in women of reproductive age to initially exclude pregnancy via urine and/or serum hCG. The diagnosis of pelvic pain is a composite picture (history, physical examination and investigations). No single fact or observation elicits the diagnosis. When evaluating pelvic pain, as with any clinical presentation, it is important to ask about the onset, location, quality, severity, radiation, duration, aggravating and alleviating factors and any temporal changes of the pain overtime. In addition, one must ask about associated symptoms, such as nausea, vomiting, diarrhea, fever, flank pain, dysuria, hematuria, pyuria, frequency, urgency, vaginal bleeding and vaginal discharge. The medical history should focus on the patient's last menstrual period, age of onset of menarche, sexual history, history of sexually transmitted diseases and a complete obstetric history. The physical examination should concentrate on the vital signs, abdominal and pelvic examination.

2. Materials and Methods

This prospective study was carried out in the Post Graduate Department of Radio-diagnosis and Imaging over a period of one year.

USG

An adequate history was elicited, followed by a focused clinical examination and relevant ancillary investigations of every patient was done prior to USG. A brief account of the procedure was explained to the patient with the emphasis on reassuring them prior to the procedure. Informed and written consent was taken from the patients/attendants. Ultrasound was performed with patient in supine position and using Samsung SonoAce R7 machine in the same setting with a curvilinear (3-5 MHz) and linear array multi frequency (7-10 MHz) transducer. An attempt was made to compare USG findings with clinical and operative findings wherever surgery was done.

MDCT

The study was performed with 256-slice MDCT Somatom Definition Flash (Siemens Healthcare, Forchheim, Germany) with 120 KVp and 150-350mAs and pitch of 0.6 . Images was reconstructed at a thickness of 1 mm and large FOV in cranio-caudal direction from the level of the Xiphisternum to pubic-symphysis before and after administration of oral (10-20ml water soluble contrast in 500-1000ml distilled water) and intravenous non-ionic iodinated contrast of 1.5-2ml/kg dose @ 3-4ml/s. All images were viewed in a range of soft tissue window setting. Images was reformatted in sagittal and coronal planes for analysis. An attempt was also be made to compare MDCT findings with clinical, ultrasound and operative findings wherever surgery was done.

3. Observation and Results

A total of 50 patients were included in study with 21-40 years age group, who had undergone USG for acute pelvic pain. Besides pelvic pain the associated symptoms in the study group were fever, vomiting, anorexia, weight loss and diarrhea. Acute appendicitis, Hemorrhagic cysts, ovarian dermoid, ovarian torsion, endometriotic cyst and urolithiasis were the commonly seen pathologies.

Table 1: Showing the Age Distribution in the Study Population

Age Groups (Years)	Frequency	Percentage (%)
0 to 10	-	
11 to 20	12	24%
21 to 30	10	20%
31 to 40	28	56%

Table 2: Clinical Features Of Patients

S. No	Clinical Features	No. of Patients	Percentage (%)
1	Abdominal pain	50	100
2	Fever	05	10
3	Vomiting	07	14
4	Anorexia	05	10
6	Diarrhea	02	4

Table 3: Various pathologies detected are tabulated.

No	Pathology	Frequency	Percentage (%)
1	Acute appendicitis	3	6%
2	Appendicular lump	2	4%
3	Ectopic pregnancy	4	8%
4	Ovarian dermoid	8	16%
5	Urolithiasis	5	10%
6	Hemorrhagic cyst	8	16%

7	Endometriotic cyst	6	12%
8	Ovarian torsion	5	10%
9	PID	5	10%

Table 4: Findings in Appendicitis

4 A. USG Findings

S.No	Findings	No. of Cases
01.	Non-visualize appendix	1
02.	Non compressible, aperistaltic tubular blind ended structure with diameter>6 mm	2
03.	Probe tenderness	3
04.	Periappendiceal echogenic fat.	2

4 B. MDCT Findings

1	Thickened enhancing appendix	3
2	Appendicolith	1
3	Periappendiceal stranding	3
4	Thick walled caecum and terminal ileum.	2
5	Focal perforation	0

Table 5: Findings in Ovarian Dermoid

5A. USG Findings

S. NO	Findings	No of Cases
1.	Complex cystic mass	01
2.	Dermoid plug	05
3.	Fat-fluid level	02
4.	Multiple thin echogenic bands within mass	00

5 B. MDCT Findings

S.NO	Findings	No. of Cases
1.	Cystic area of fat attenuation	07
2.	Non-enhancing soft tissue component	07
3.	Central calcification	08

Table 6: Findings in ectopic pregnancy

USG Findings

S. NO	Findings	NO. of Cases
1.	well defined gestational sac with yolk sac, separate from ovary and uterus	1
2.	Heterogenous adnexal mass	03
3.	Pelvic hematoma	02
4.	Hemoperitoneum	03

Table 7: Findings in Hemorrhagic Cyst

7 A. USG Findings

S. No	Findings	No. of Cases
1	Cystic area, internal septation	3
2	Fibrin strands	3
3	Organised clot	2

7 B. MDCT Findings

S. NO	Findings	No. Of Cases
1	Cyst with internal high density	5
2	Fluid-fluid level	3

Table 8: Findings in Endometriosis

USG Findings

S. NO	Findings	No. Of Cases
01	Multi-loculated cystic area with homogenous ground glass echos.	03
02	Echogenic foci of calcification within wall.	03

Table 9: Findings in Torsion USG Findings

S. NO	Findings	No. of Cases
1	Enlarged, edematous ovary with peripherially arranged cystic area, deviation of uterus, no flow on color doppler with minimal surrounding free fluid.	5

4. Discussion

One of the most common gynecological causes of acute pelvic pain is ruptured or hemorrhagic corpus luteum cyst. A hemorrhagic ovarian cyst is a cyst that is filled with blood, which usually occurs when a blood vessel breaks into the cyst. Pain from a hemorrhagic cyst is probably due to stretching of the ovarian capsule, as opposed to pain from ovarian cyst rupture which is due to peritoneal irritation. Similar to ovarian torsion and ruptured ovarian cysts, patients with a hemorrhagic cyst also present with unilateral lower abdominal and/or pelvic pain associated with nausea, vomiting and/or vaginal bleeding. Because hemorrhagic cyst evolve in different stages, fresh blood on the ultrasound initially appears anechoic, later transforming to a blood clot (echogenic content with thin septations) and finally resolving, the echogenicity of the hemorrhagic cyst diminishes as the red blood cell undergoes hemolysis. The typical appearance on ultrasound is that of an enlarged ovary containing multiple echogenic areas (representing blood clots) in a reticular pattern due to clot (representing fibrin strands, not tissue septations) retraction. In our study 8 patients had hemorrhagic cysts. USG revealed a complex ovarian lesion with numerous thin septations. Color Doppler reveals peripheral vascularity. Pulsed Doppler waveform analysis demonstrates low to moderate impedance to blood flow signals, typical for luteal conversion.

Dermoid cysts (mature cystic teratoma) are the commonest germ cell neoplasm and in some series the most commonly excised ovarian tumour. They are composed of tissue from at least two of the germ cell layers and often contain hair, sebum and teeth. These tumours show a wide range of ultrasonic appearances because of their variable composition. On account of this they may mimic a variety of other pelvic masses. However, the ultrasonic appearance can be distinctive, and a number of sonographic signs characteristic of dermoid cysts have been described. In our study of 8 patients typical appearances include a shadowing echodensity or dermoid plug; diffuse or regional high amplitude echoes; the tip of the iceberg sign; dermoid mesh; fat–fluid levels and intracystic floating balls.

Endometriosis is a gynaecological condition in which the endometrial cells (lining cells) of the uterus (womb) grow in places outside the uterus. Cystic endometriosis or endometrioma is a type of cyst formed when endometrial tissue grows in the ovaries.

It affects women during the reproductive years and may cause chronic pelvic pain associated with menstruation. The ovaries are involved in approximately 75% of patients with endometriosis. In our study 6 patients had endometriotic cyst as cause of pelvic pain. On ultrasound endometrioma can be variable but the great majority (about 95%) of patients

present with a classic homogeneous, hypoechoic cyst with diffuse low level echoes. Rarely it is anechoic, mimicking a functional ovarian cyst. Endometriomas can be multilocular and have thin or even thick septations.

Pelvic inflammatory disease: Pelvic inflammatory disease refers to the infection of the upper female genital tract (uterus, fallopian tubes, oviducts and ovaries) caused by ascending spread of bacteria from menstruating female who has had multiple sexual partners and does not use barrier contraception and complains of pelvic pain and/or lower abdominal pain with vaginal discharge. 5 patients had PID as a cause of acute pelvic pain which on Sonography showed enlarged ovaries and poorly defined margins of the pelvic organs. In acute salpingitis, the fallopian tube is thickened and hypoechoic. It can be differentiated from acute appendicitis on transvaginal US by finding the connecting organ to the tubular structure. With salpingitis, the structure can be traced to uterus. Another way to differentiate these two entities is by pattern recognition. If the structure is multilayered it could be consistent with appendicitis, whereas a single layered structure would be more consistent with salpingitis.

Acute cystitis: Urinary tract infections encompass both the lower (cystitis) and upper urinary tracts (pyelonephritis), The main organisms responsible for both upper and lower urinary tract infections are E. coli. Other organisms include Proteus species, S. saprophyticus, Klebsiella species and Enterococcus faecalis. Classically, patients present with dysuria, urgency, frequency, lower abdominal and/or pelvic discomfort. The pain may be referred to the right and left lower quadrants and flanks. Many patients may have suprapubic tenderness and/or costovertebral tenderness. In most cases, the diagnosis is based on clinical features along with urine analysis and cultures. These symptoms are very similar to all the previous cases. Pelvic inflammatory disease, vaginitis or cervicitis may also cause dysuria. In our study there were 4 patients who presented with above said complaints. Ultrasound has the advantage of evaluating the spectrum of pelvic pathologies. A transabdominal ultrasound for this case revealed a urinary bladder filled with sludge and mobile echoes. Antimicrobial treatment is directed to the most prevalent microorganisms.

Ovarian torsion: Total of 5 patients had ovarian torsion as cause of acute pelvic pain. On USG ovary is usually enlarged and hypoechoic, with peripherally stacked debris containing follicles. Color Doppler US is invaluable in the diagnosis of this entity and in differentiating it from acute oophoritis. If the torsion is complete there is no venous or arterial flow within the ovary on color Doppler examination. The Doppler waveform may show reversal of flow in the ovarian pedicle. If the torsion is incomplete, color Doppler examination may show highly resistive flow within the ovary. Primary ovarian torsion occurs in adolescents, whereas in females past adolescence, torsion usually involves ovaries containing large cysts or masses.

Acute Appendicitis and Appendicular Lump: Total of 5 patients had appendicular inflammation as the cause of pelvic pain. Most common sonographic feature were (a) probe tenderness (b) non-compressible, aperistaltic tubular blind gut loop with thickness more than 6 mm, (c) periappendiceal fat inflammation.

Urolithiasis: 5 of the patients had lower ureteric calculi and upstream hydronephrosis as the cause for their pain. Ultrasound could demonstrate hydroureteronephrosis and ureteric calculus.

5. Conclusion

Acute pelvic and/or lower abdominal pain in nonpregnant women of reproductive age is an extremely common presentation to emergency departments, urgent care centers and outpatient office practices. Acute pelvic pain includes a broad spectrum of clinical entities that range from benign self-limited disorders to illnesses associated with high morbidity, requiring the clinician to make an urgent therapeutic decision. Prompt diagnosis is essential to minimize morbidity, which remains substantial if a complication occurs.USG offers a prompt beside safe and painless method for evaluation of cause of pain. MDCT offers an unparalled clarity, sensitivity and specificity in diagnosing and ruling out certain causes of pelvic pain.