Infection of the female upper genital tract: Pictorial review by computed tomography according to clinical classification


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Abstract: Upper genital tract infection (UGTI) or female pelvic inflammatory disease (PID) comprises a number of inflammatory conditions of the female reproductive tract. The clinical presentation is varied and most occur as a lower quadrant abdominal pain or pelvic pain, and may even be diffuse and often manifest as an acute abdominal pain difficult to diagnose. The clinical presentation and anatomic involvement are varied. In 1982 Monif designed a classification based on the anatomical commitment of the affected structures, from a localized infection such as salpingitis, to more serious conditions such as life-threatening ruptured tubo-ovarian abscess (TOA). Images together with clinical history form a fundamental basis for the diagnosis and so define therapeutic management. In the following article a series of cases are presented with their main findings to the computed tomography (CT) classified according to Monif’s staging.

Keywords: Computed tomography (CT), Monif staging, Pelvic inflammatory disease (PID).

Introduction
The infection of the upper genital tract (UGTI) is a common condition among women of reproductive age(1). It applies to the infection and resulting inflammation of the upper tract of the female reproductive organs, including the endometrium, fallopian tubes and ovaries(2). Literature reports estimate that it is one of the most common diseases of the female gender affecting 1 million women, representing 275,000 hospitalizations annually in the USA(3,4). In Chile, in the Gynecology Service of the San Borja Arriarán Hospital, 2.4% of those discharged in 1991 were due to this cause(5), in other reports about 39% of patients affected by PID corresponded to TOA which has increased especially in women older than 40 years of age(6).

UGTI is usually caused by an ascending type infection, with etiology well elucidated by the literature, where the main agents involved are Neisseria gonorhoeae or Chlamydia trachomatis, although between 30% - 40% of cases are from polymicrobial causes(7).

Among the risk factors for PID are included young women, multiple sexual partners, high coital frequency, low socioeconomic status, douching and the use of intrauterine device (IUD) (especially during the first few months after insertion) as well as other forms of pelvic instrumentation(2).
Within the secondary complications to an UGTI those resulting from damage to the uterine horn, scarring and occlusion(2) are highlighted. Patients who have had an UGTI are at six times higher risk of ectopic pregnancy; plus 20% of patients with a history of UGTI will complain of chronic pelvic pain(1). Among the most serious complications can be found infertility associated with blocked fallopian tubes that occur in 8% of patients after a single episode of UGTI, with an increase of up to 20% after two episodes of UGTI and up to 40% after three episodes(3).

Due to the variety of complications that occur in the short and long term it is important to have an early and accurate diagnosis of UGTI, in order to achieve timely treatment. However the case history presented is often varied and nonspecific, presenting symptoms such as fever, abdominal pain or pelvic pain, vaginal discharge, vaginal bleeding, dyspareunia, dysuria, cervical or adnexal tenderness, nausea, vomiting, and other vague constitutional symptoms(3,7,8). Moreover, the literature reports that up to 35% of patients are asymptomatic with PID(2).

Laparoscopy has long been the standard reference in the definitive diagnosis of UGTI(9,10), however, it requires anesthesia in addition to being an invasive procedure that can lead to complications(9). This is preferred in patients with moderate or severe pelvic pain.

In the USA, transvaginal ultrasound is a routine procedure used in patients with pelvic pain(11). Previous studies have shown that transvaginal ultrasound has achieved good results in the diagnosis of PID when findings include uterine tubes filled with liquid and/or thickened(12).

Moreover CT has been used in the diagnosis of tuboovarian abscesses(13) and has been useful in cases of PID of difficult clinical-ultrasound diagnosis(14,15), often being the diagnostic tool.

This article aims to develop a pictorial review evaluating the different clinical stages of PID, according to the classifications proposed in 1982 by Monif(16), described in Table I and their correlation with multislice CT, analyzing the main findings with images of each.

**Stage I: Acute salpingitis without peritonitis**

An ascending infection and inflammation of the fallopian tubes, occurs with edema.

The CT scan is usually negative, however, changes can be found as a minimum amount of free fluid in the base of the recto-uterine pouch; increased volume of the utero-sacral ligament; increased density of the surrounding adipose tissue; thickening of the walls of the uterine tubes; thickened endometrium with liquid inside; and the uterus may lose sharpness of its contours and boundaries with the adnexas(2). The ovaries may be enlarged and lose corticomedullary differentiation(17). The aim in this stage is to treat the infection(18).

**Case report:** 44 year old patient, no morbid history. IUD user, consultation for symptoms of 3 days with hypogastric abdominal pain radiating to right lumbar fossa, associated with fever, urinary symptoms, nausea and vomiting. Consultation in the Emergency Department, hemodynamically stable, the abdomen is sensitive, without signs of peritoneal irritation. Abdomen-pelvic CT with contrast is performed, showing left acute salpingitis.

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**Figure 1.** Salpingitis without signs of acute peritonitis. Cystic mass in the pelvic cavity under the left adnexa, with lobed edges and tubular appearance, associated with an increase in the density of the adjacent fat. No fluid collections are evident. Uterus size preserved with IUD in situ.
Case report: 40 year old patient, consultation for symptoms of a few hours with abdominal pain in the right iliac fossa without Blumberg. Feverish and hemodynamically stable. Physical examination highlights pain with low pelvic palpation. Abdomen-pelvic CT with contrast is performed, showing acute right salpingitis.

Figure 2. Acute right salpingitis (arrows). In both axial and coronal slice can be identified, in relation to the right adnexa, a hypercaptant walled tubular structure with hypodense content corresponding to salpingitis (arrow heads). In both slices is evident, an enlarged uterus, with thickened hypercaptant walls, with hypodense content therein, findings which suggest endometritis.

Case report: 32 year old patient, IUD user, consultation for diffuse abdominal pain, feverish. On physical examination the abdomen is distended, with pain on pelvic palpation without Blumberg, CT with contrast of the abdomen and pelvis is requested.

Figure 3. Acute Salpingitis without peritonitis. Inflammatory changes in the pelvic fat can be seen in a, b and c. a) Heterogeneity of the uterine density, with increased uptake and thickening of wall, poorly defined edges, enlarged, signs suggesting endometritis (arrows). b) Tubular appearance hypodense images with contrast enhancement of the wall, serpentiginous shape corresponding to the uterine tube, with liquid content and inflammatory changes (arrow head). c) Cystic mass in relation to left adnexa with commitment of the adjacent fat and displacement of structures in relation to that adnexa (arrows), uterine commitment described in coronal slice can be seen (arrow head).

Stage II: Acute salpingitis with peritonitis

This occurs because of an evolutionary process of the UGTI that has not received treatment. The aim in this stage is to preserve fertility. In the imaging study can be found free fluid in the base of the recto-uterine pouch or abscesses with septations. Case report: 39 year old patient, consultation for symptoms of 24 hours of diffuse abdominal pain, cramping, associated with bloating and nausea, no bowel movement or passing of wind. On examination a distended abdomen and tenderness to palpation was evident, positive Blumberg. CT with contrast of the abdomen and pelvis was performed showing acute left salpingitis with secondary pelvic peritonitis, with involvement by contiguity of the sigmoid colon and a small collection in the base of the recto-uterine pouch.
Figure 4. Acute salpingitis with peritonitis. a) Hypercaptant walled tubular image adjacent to left uterine horn, suggestive of acute salpingitis (arrow). Hypodense image that descends toward the base of the recto-uterine pouch, compatible with a collection of 6 x 4 cm (arrow head). Image of IUD in situ (triangle). b) Increase in the density of the adjacent fat and parietal inflammatory changes of the sigmoid colon by contiguity. Ovaries appeared normal.

Case report: 44 year old patient, consultation for clinical symptoms of acute abdomen. CT of the abdomen and pelvis is performed showing pelvic peritonitis with left adnexal origin and IUD in situ.

Figure 5. Acute salpingitis with peritonitis. Uterus with IUD in situ. Focal hypodense image of cystic appearance in relation to right adnexa (arrow). Left adnexa with hypercaptant thickened walls, with inflammatory changes of the local fat (arrow head).

Case report: 42 year old patient, consultation for symptoms of several days with pain in left lumbar region. CT of the abdomen and pelvis is performed showing pelvic peritonitis secondary to inflammatory process of bilateral adnexal origin.

Stage III: Salpingitis with TAO formation

Progression of the infection and inflammation determine destruction of normal anatomical structures, with the formation of an inflammatory mass which involves both the ovary and the oviduct. Treatment is usually medical, however, there are indications when a surgical resolution is necessary.

The release of purulent content occurs into the peritoneal cavity with inflammation of adjacent viscera and subsequent agglutination of these, defining the tubo-ovarian complex that it involves: ovaries, broad ligament, intestine and omentum.

Surgical indications may be immediate or mediate. Within the immediate are described a tumor greater than 8 cm, poor response to antibiotics after 72 hours or septic shock. Within the mediate is described a tumor that doesn’t decrease more than 50% in size over 6 months and chronic pelvic algia. The goal of treatment in this stage is to conserve the ovary.

The CT findings include solid cystic adnexal mass.
with contrast enhancement of the wall, dilatation of the uterine tubes with wall edema and hypercaptation of the contrast, of serpentinous appearance, alteration of the fat and inflammatory involvement of adjacent organs, thickening of the uterine ligaments with the use of contrast and gas in the oviducts, which despite being a very specific sign of TOA; is an unusual finding [8,21,22].

Case report: 20 year old patient, with a history of multiple urogenital surgeries. Consultation for symptoms of 2 days of hypogastric abdominal pain in the right iliac fossa. CT of the abdomen and pelvis was performed showing right tubo-ovarian abscess, neobladder and mild bilateral hydroureteronephrosis.

Case report: 41 year old patient, consultation for month long symptoms of pain in left flank, arrives with Tº37.4°C and hemodynamically stable. On examination painful abdomen in the left lower quadrant is obvious, without signs of peritoneal irritation, no palpable masses. CT of the abdomen and pelvis is performed, showing left ovarian abscess and collection in the base of the recto-uterine pouch.

Figure 7. Salpingitis with TOA formation. a) In the right adnexal region a complex cystic mass is observed with serpentinous tubular component, which corresponds to a pathologic dilation of the uterine tube. This cystic formation shows capsular enhancement by contrast and reaches a diameter of 7.5cm (Arrow). b) In right hemi pelvis, in relation to right adnexa, a cystic formation that has wall enhancement, of homogeneous content, partially displacing bladder to the left, is observed (Arrow). Hydroureteronephrosis, dilatation of the renal pelvis and proximal bilateral ureter, was observed (Arrow heads). Relation of adnexal mass with large bowel loops, which presents thickened walls and inflammatory involvement of peripheral fat (Triangle). (U) Uterus displaced towards the left, with heterogeneity in the density and indistinct borders. a and b. Perilesional fat presents heterogeneity in its density indicating significant inflammatory changes.

Figure 8. Salpingitis with TOA formation. Arrows. Increase in volume of the left adnexa, with multiple abscesses within (arrowheads). Inflammatory changes of the left uterine tube and mesosigmoid fat, with parietal thickening reactive of this. Triangle. Adjacent to the adnexa, in the base of the recto-uterine pouch, a small collection is observed. U. Uterus in normal (anteversion and antiflexion) position with IUD in situ.
Stage IV: Ruptured ovarian tube abscess

Stage of high mortality, especially when the diagnosis is delayed. Should be suspected when there is a change in the clinical symptoms of a patient with a PID\(^{(20)}\). Usually the physical examination is inconclusive, being able to find a slightly distended abdomen, decreased bowel sounds and signs of peritoneal irritation, such as increased muscle resistance with eventual Blumberg\(^{(23)}\).

Management is urgent with exploratory laparotomy, generous washing of the abdominal-pelvic cavity and resection of the involved organs\(^{(24)}\).

The aim of treatment in this stage is to save the life of the patient\(^{(18)}\).

Case report: 39 year old patient, IUD user changed a month ago. Consultation for symptoms of 20 days of abdominal pain, initially hypogastric and then diffuse, associated with feeling feverish, chills, compromised general health, nausea and vomiting. Admitted with compensated septic shock. CT of the abdomen and pelvis is performed showing multiple bilateral ovarian tube abscesses with signs of peritonitis.

Case report: 27 year old patient. Consultation for symptoms of a few hours for abdominal pain associated with nausea. Admitted hemodynamically stable and feverish. CT of the abdomen and pelvis with contrast is performed, showing pelvic peritonitis secondary to a ruptured TOA.

Figure 9. Ruptured Tubo-ovarian abscess. Uterus in normal position. (Arrows). Both adnexa are replaced by multiple fluid collections with hypercaptant walls, compatible with abscesses (arrow head). Fluid level within the cavity is seen, very suggestive sign for ruptured TOA. Triangles. Major alteration of inflammatory component perilesional fat and free peritoneal fluid is observed.

Figure 10. Ruptured ovarian tube abscess. Dilated small bowel loops with mild wall thickening can be seen. U. Uterus with IUD in situ (arrows). Right adnexa increased in size, of 6 cm for largest diameter, heterogeneous, with cystic areas in its thickness and enhancement capsular by contrast. Triangle. Increased density of the pelvic fat and slight amount of free intraperitoneal fluid.
Conclusion

The presentation of a UGTI can be varied depending on the anatomical involvement and severity of the symptoms.

UGTI is one of the multiple differential diagnoses of acute abdomen. As an initial imaging study use of transvaginal ultrasonography is recommended, this being at times insufficient to clarify diagnosis, it is under these conditions that CT of abdomen and pelvis is very useful. It is important to note that currently the use of MRI has greater sensitivity and specificity than CT, as well as being less risky for not using ionizing radiation, especially in young women.

The clear imaging and clinical correlation is very important, because the presentation and severity of the UGTI is not directly related to the findings in images, that is, symptoms of feverish acute abdomen can be the clinical expression of both a salpingitis as well as a TOA.

When a UGTI is suspected, the CT of abdomen and pelvis, besides being a useful tool for diagnosis, classifies more accurately the clinical stage, that is to say, the suspected anatomical compromise in which the disease is found, which will influence the severity and therapeutic decision of the treating physician.

Bibliography