The diagnosis of uterine and/or tubal pathology as causes of female infertility represents a fundamental step in the evaluation of the infertile couple. Apart from the invasive diagnostic procedures, several others diagnostic techniques useful to the clinical evaluation of the uterine cavity and tubal anatomy are: transvaginal sonography (TVS), hysterosalpingography (HSG), hysteroscopy and hydrosonography (HDS) and laparoscopy.

**Summary**

The diagnosis of uterine and/or tubal pathology as causes of female infertility represents a fundamental step in the evaluation of the infertile couple. Apart from the invasive diagnostic procedures, several others diagnostic techniques useful to the clinical evaluation of the uterine cavity and tubal anatomy are: transvaginal sonography (TVS), hysterosalpingography (HSG), hysteroscopy and hydrosonography (HDS) and laparoscopy.

The aim of this study was to compare the diagnostic accuracy of TVS, HSG, hysteroscopy, HDS and laparoscopy in evaluating uterine cavity and tubal patency in infertile women.

**Introduction**

The anatomical/functional evaluation of female pelvic organs plays a key role in the clinical assessment of infertility in infertile couples.

The clinical evaluation of a great number of infertile/subfertile women (7-16%) (1-3) might be based on an evaluation of the risks/benefits and costs/benefits ratio of diagnostic tools. Therefore, a low cost and risk methodological approach should be addressed as a "first choice" investigation, later followed by more complex or invasive procedures (4).

Among etiological factors of female infertility other reverse "uterine" factors are described. In fact, despite uterine malformations are detected only in 0.16% of fertile women, they have a mean prevalence of 3.5% in the infertile women showing a deep causal relationship nexus between the two events. On the contrary, the relation between leiomyomas and infertility is less strong. The myomas can alter fertility with many mechanisms such as delaying spermatozoa moving up and progression, altering uterine, endometrial and tubal contractility, compressing or occluding salpinx, hindering oocyte capture or, generically, altering endometrium and consequently its implantation. Furthermore, intraligamentous myomas can alter tubal function, while subserous fibroids do not. Consequently, it is clear that the myoma location is more important than myoma dimension. It comes that the use of accurate diagnostic procedures are needed not only to detect them, but particularly to identify their topography. However, although 25% of women suffer from uterine myomas (7-8), they are associated to infertility in only 5-10% of cases and considered the main infertility cause only in 2-3% of cases (9).

Submucous and some intramural fibroids, polyps, intrauterine synechiae and some chronic endometritis (chlamydia), can be responsible for mechanical and/or vascular endometrial alterations that cause stromal lesions (atrophy, ulceration). Adenomyosis can interfere with fertility as already described for myomas, but also by specific mechanism.

Extraterine adhesions due to myomectomy (in particular when the posterior uterine wall is involved) or intraterine adhesions determined by surgical procedure are important iatrogenic factors causing uterine or tubo-peritoneal factor alterations. For all these reasons, to avoid these iatrogenic risks, the less invasive methodology might be chosen when a surgical procedure is needed.

On the basis of these considerations, hydrosonography (HDS) seems to offer a good accuracy in identifying the causes of infertility, with the lower costs and risks for the patient. In the evaluation of uterine and tubo-peritoneal factors causing infertility, almost all the protocols retain hysterosalpingography (HSG), hysteroscopy and laparoscopy, first choice diagnostic tools. For a long time HSG was the sole procedure providing important details about the presence of
intrauterine anomalies and tubal patency. In the 1970's the introduction of the hysteroscopy allowed the direct visualization of uterine cavity, but its value was controversial for a long time. Later, the clinical use of ultrasound, and particularly of transvaginal sonography (TVS), did not modified the female infertility protocols, essentially based on HSG, hysteroscopy and laparoscopy. For the first time in 1986 the instillation of sterile saline solution into the uterine cavity was described (10).

In the present study we will evaluate the effectiveness of HDS, in the first step evaluation of female infertility, comparing its diagnostic accuracy to that of HSG, hysteroscopy and laparoscopy.

Materials and Methods
To determine the accuracy of HDS versus HSG, hysteroscopy and laparoscopy one heterogeneous group of patients was enrolled.

The studied group was composed by 130 infertile women with a mean age 33.2 ± 5.1 (range 23-47, interquartile 27-35) that underwent HDS (Siemens Sonoline SL2 and Siemens Elegra Millenium Edition, with 5-7.5 MHz transvaginal probes).

Before or after transvaginal saline solution infusion, they underwent one or more different diagnostic/therapeutic procedure such as HSG, hysteroscopy, curettage and endometrial biopsy, and laparoscopy, all considered as reference.

The HDS findings, recorded without knowing the results of others investigations, were compared with others methodology findings and with histology.

Results
In this group of infertile patients it was possible to determine HDS diagnostic accuracy versus uterine malformations and uterine cavity pathology. As concern tubal patency, in 52 women HSG was compared with HDS, whereas in 48 cases the laparoscopic chromopertubation was compared with both HSG and HDS.

The HDS findings concerning the uterine cavity morphology was correct in 126 cases. 20 submucous myomas (associated to polyps in 4 cases), 18 cases of endometrial polyps, 16 uterine malformations, 4 intrauterine adhesions and 68 normal intrauterine findings with endometrial pattern synchronous with the menstrual cycle phase, were correctly identified. There was discrepancy in 2 cases: either HDS and hysteroscopy demonstrated the presence of polyps, but the histologic examination identified only endometrium in secretive phase.

The comparison between HDS and hysteroscopy showed an almost equal diagnostic capability. Using as reference the histologic results, HDS showed a sensitivity of 100%, a specificity of 97.1%, a PPV of 96.8% and a NPV of 100%.

As concerned tubal patency the results that derive from the comparison between HSG and HDS agreed in 73% of cases (85.4% of tubes), with an higher prevalence of tubal occlusions at HSG examination. In 48 women the comparison between laparoscopy and HSG showed an agreement in 70.8% of cases (82.2% of tubes), while between laparoscopy and hydrosonography in 79.1% of cases (88.8% of tubes). Also in this second group HSG showed an higher prevalence of false tubal occlusion. All bilateral tubal occlusions were correctly identified by HDS.

Conclusions
From the present results some considerations were drawn: HDS made by skilled operators allows an accurate evaluation of uterine cavity and malformations, particularly in young women, reaching a diagnostic accuracy similar to that of hysteroscopy, improving the examination compliance and lowering both risks and side effects.

As first conclusion HDS could avoid, at least at the first step, all the other diagnostic procedures, lowering costs and reaching a high diagnostic accuracy with a non invasive, good compliance, methodology.

The evaluation of tubal patency is traditionally considered fundamental in the study of causes of infertility and it represents one third of the total cost in the management of the infertile couple. Doubting about the real utility of the investigations concerning infertility some researchers suggested to direct the available resources to support the assisted reproduction techniques without dissipate them in dangerous, expensive, and perhaps useless diagnostic investigations, necessary to access, after one or two years of infertility, in the IVF-ET program. On the contrary, other researchers assert that there is still today a good reason to evaluate tubal factor, that alone represents about 30% of the causes of female infertility. In this debate HDS could represent a good compromise.

Doubts about the HDS utility in the study of tubal patency are still existing now. The results obtained show how the accuracy of this methodology is at the same level of HSG's, when the two techniques are compared with laparoscopic chromopertubation.

Accordingly to the literature, the present study confirms that HSG is a technique that presents a considerable number of false positive results (that lead inevitably to laparoscopy) whilst, on the
contrary, HDS has a lower false positive results. Moreover, it is important to notice that in the sample analyzed, HDS never failed the presence of a bilateral tubal occlusion. Generally this pathologic finding, is easily detectable also from a less experienced sonologist by looking the absence of fluid in the Douglas space, always present after few minutes from the saline infusion instillation. Mol (11) documented how in a population of infertile women that underwent HSG, only the bilateral tubal occlusion was strongly correlated with a low percentage of pregnancy (0.30), while the fecundity rate ratio between women without tubal pathology and women with monolateral occlusion was almost equal (1 vs 0.81).

In according with our results, a recent study (12) stated that HDS technique can be considered the most accurate test in the evaluation of uterine cavity diseases in infertile women and in particular in case of polypoid lesions. In fact, using hysteroscopy as gold standard, HDS showed the same diagnostic accuracy of hysteroscopy in case of polypoid lesions and endometrial hyperplasia, a sensitivity of 77.8% for uterine malformations (HSG 44.4%) and of 75% (PPV 42.9%) in the detection of intrauterine adhesions (HSG 75% PPV 50%). Moreover Goldberg (13) found that in the evaluation of patients with infertility or recurrent pregnancy loss and uterine abnormalities on HSG, HDS was more accurate than HSG and provided additional information about uterine abnormalities particularly on the relative proportion of the intracavitary and intramymetrical components of submucus myomas, as well as extracavitary myomas and the adnexae. Later, concerning the appearance of uterine cavity, Darwish(14) confirmed that HDS agreed with hysteroscopy in 72.2% of cases, while the appearance of tubes obtained using HDS agreed with laparoscopy in 72.4% of cases (right tube) and 60.5% (left tube). Using as direct indicator of tubal patency the appearance of fluid in Douglas space the agreement between HDS and laparoscopy rised to 88.1% (one tube) and to 85.7% (both). Also in the evaluation of abnormal uterine bleeding HDS seems to have an important role (15).

Therefore, the use of HDS as first approach procedure in the protocols for the evaluation of female infertility, allow either a significant reduction of the invasive procedures risks and of related costs without losing accuracy. In conclusion, HDS represents today the gold standard procedure in the infertile couple diagnostic approach.

References:

7. Lopes P. In an infertile woman, does the presence of one or several myomas of less than three cm in diameter justify a myomectomy? Contracept Fertil Sex 25: 350-1, 1997.

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