Transvaginal Ultrasound Accuracy in the Hydrosalpinx Diagnosis

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Hydrosalpinx is a condition with a crucial prognostic role in reproduction, and its diagnosis by a non-invasive technique such as ultrasound is key in achieving an adequate reproductive assessment while avoiding unnecessary laparoscopies.

Keywords: hydrosalpinx; transvaginal ultrasound; diagnosis

1. Introduction

Infertility is related to tubal disease in 35% of cases [1]. Distal and proximal occlusion of the tubes—at the fimbrial and at the cornual end—cause fluid filling of the tubes, distending them and leading to the formation of hydrosalpinx. In vitro fertilization (IVF) therapies have changed the reproductive chances in sterility cases related to tubal obstruction, but hydrosalpinx has a negative impact on IVF outcomes according to the most recently published systematic review and meta-analysis on the topic [2].

Hydrosalpinx can develop after the onset of post-surgical adhesions or after a hysterectomy, but more frequently, its occurrence is related to an antecedent of acute pelvic inflammatory disease (PID) [3]. Taipale et al. followed a cohort of patients diagnosed of acute PID for three months, and after this period, 26.7% (23/86) of them had a sonographic suspicion of hydrosalpinx [4].

The gold standard for the hydrosalpinx diagnosis is histological confirmation, albeit laparoscopic direct observation is also an accepted method [5]. Non-invasive techniques such as ultrasound have been proposed as having a role in its diagnosis in order to achieve adequate reproductive assessment while avoiding unnecessary laparoscopies.

Classically, since a fluid-filled tube is theoretically visible by transvaginal ultrasound (TVS) as a cystic mass, hydrosalpinxes could be identified sonographically. Nevertheless, in some series it has been proved that they could be missed, especially when the bowel is occupied by gas and/or fecal material or when adhesions alter the normal pelvic anatomy [6].

Different authors have described the main sonographic characteristics to accurately diagnose hydrosalpinx. Timor-Tritsch et al. described this lesion as being typically an elongated-shaped cystic mass with anechoic or hypoechoic content, convoluted and with the presence of incomplete septa due to the ballooning and doubling-up of the tube. These incomplete septa originate as triangular hyperechoic wall-protrusions into the lumen, not reaching the opposite wall [7], and they are found in up to 85–93% of chronic hydrosalpinxes [8,9].

The presence of the called “beads-on-a-string” sonographic pattern is also a specific and reliable sign of chronic hydrosalpinx—hyperechoic mural nodules measuring 2–3 mm seen on the transverse section of the fluid-filled tube, which correspond to the flattened and fibrotic remnants of the endo-salpingeal folds [10,11].

Hydrosalpinx can also be the result of a present acute salpingitis, and not just the chronic consequence of a previous PID [12]. Some sonographic signs, nonetheless, contribute to establishing a differential diagnosis among acute and chronic salpingitis: the tubal wall is thickened in acute PID but not in the chronic hydrosalpinx [13,14]; the typical “beads-on-a-string” sign is not visible in acute salpingitis, but the “cogwheel sign” is found instead [13,15].
2. Summary of Evidence

The pooled estimated sensitivity is 84%, with very low observed heterogeneity ($I^2 = 0.00$). The pooled estimated specificity is 99%, with a remarkable heterogeneity ($I^2 = 82.68$) which cannot be explained by the differences in sample size, publication year, or on prevalence among the selected studies. Notwithstanding, it could be caused by the low PPV found in two of the studies since it decreases to $I^2 = 5.23$ when excluding these articles.

The article published by Bhatty et al. is the one with the lowest specificity (94.68%) and presents a low PPV (50.00%) as well. It is also the one with the lowest quality assessment at QUADAS-2, since the authors do not provide clear information on the patient selection and methodology used. Notwithstanding, due to its small sample size ($n = 100$, number of hydrosalpinxes = 10), the inclusion or exclusion of this specific study in the statistical analysis does not have a major impact on the pooled results.

The differences in TVS performance among the included studies could be related to differences in the sonographer’s experience, but this is not clearly stated in three out of the six studies.

3. Interpretation of the Results and Relevance of the Topic

There is increasing evidence showing that hydrosalpinx has a deleterious impact in IVF results because of its association to decreased implantation, clinical pregnancy, and ongoing pregnancy rates; and to higher risk of ectopic pregnancy and miscarriage. This has been related to the negative impact of hydrosalpinx fluid on endometrial receptivity, to a toxic effect on early embryos, or to a mechanic or vascular alteration interfering with implantation.

Various approaches have been proposed for managing hydrosalpinx in the context of IVF. According to the last meta-analysis on this topic, the best IVF results are related to hydrosalpinx removal (salpingectomy) compared to other conservative managements, like proximal tubal occlusion—either surgical or hysteroscopic occlusion—or hydrosalpinx ultrasound-guided aspiration with or without sclerotherapy.

Although there are sufficient studies in the literature showing an improvement of the IVF performance after salpingectomy in the context of hydrosalpinx, no-one has yet assessed the overall evidence on the diagnostic accuracy of TVS for hydrosalpinx, even when it is the most used diagnostic tool for this entity in reproduction clinics.

Ultrasonography has a 99% pooled specificity. Therefore, after diagnosing hydrosalpinx through pattern recognition there is low probability in finding a different adnexal mass or no masses at all during its laparoscopic removal. By contrast, the overall pooled sensitivity and LR+ are lower, suggesting that some hydrosalpinxes could be missed or confused with other adnexal masses. This fact is also relevant, especially when considering the impact of the presence of hydrosalpinx in IVF outcomes. Additionally, another important point is the inter-observer reproducibility of TVS diagnosis of hydrosalpinx. There is no study addressing this issue. The assessment of this issue could help to define which are the more precise ultrasound features for establishing the diagnosis of hydrosalpinx, and probably to define the need for refining or re-defining the diagnostic criteria.

Overall, it is important to acknowledge that the population of all the studies included in the current meta-analysis are women with adnexal masses of all ages, not general population nor infertile women. It is well known that in infertile women, tubal disease could represent up to 35% of the causes of infertility with a mean prevalence of hydrosalpinx between 10% and 13% when diagnosed by ultrasound. Therefore, it could be presumed that with an increased prevalence of hydrosalpinx in this specific population, TVS could have a better performance.

References


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