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## THE ROLE OF LAPAROSCOPY, HYSTEROSCOPY AND FALLOPOSCOPY IN TUBAL CAUSES OF INFERTILITY

DR AKINTOBI ABDULHAKEEM OLAJIDE

MBBS, SENIOR REGISTRAR OBS & GYNAE

UNIVERSITY OF ILORIN TEACHING HOSPITAL, ILORIN. NIGERIA.

### Abstract

Infertility is defined as the inability of a couple to conceive after one year of unprotected and adequate sexual intercourse, it is a public health problem affecting between 10 to 15% of couples. Primary and secondary infertility are commonly associated with tubal factor as aetiological factor. The aim of this review is to evaluate the role of laparoscopy, hysteroscopy and fallopscopy in tubal causes of infertility. Advent of minimal access procedures have redefined the evaluation and treatment of infertile couple particularly tubal infertility. The various forms of endoscopic procedures have been shown to demystify and redefine the bounds of “unexplained infertility” by producing new diagnostic evidence. The use of laparoscopy, hysteroscopy, fallopscopy, fimbrosopy and chromotubation with other conventional infertility work-up procedures to resolve infertility problems have shown very promising results.

Key words: tubal infertility, laparoscopy, hysteroscopy, fallopscopy.

## Introduction

### INFERTILITY

Infertility is a public health problem especially in developing countries affecting 10 to 15% of couples. It is defined as the inability of a couple to conceive after one year of unprotected and adequate sexual intercourse. It can be primary in which case the couple/ woman has never conceived before or secondary when there is prove of prior conception irrespective of the outcome. In relation to causes, infertility is classified into ovulatory dysfunction, fallopian tubal infertility, male factor infertility and “unexplained infertility” each accounting for 30%,30-40%,30% and 10% respectively<sup>1-5</sup>

### TUBAL INFERTILITY

Tubal factors accounts for up to 40% of infertility with varied and diverse aetiologies. Pelvi-peritoneal adhesions (mostly sequels of prior infections from organisms like *Chlamydia trachomatis* and *Neisseria gonorrhoea*) constitute the single most common class of tubal pathology responsible for tubal infertility<sup>6</sup>. Other conditions include endometriosis, hydrosalpinx and proximal tube obstruction due to complications of endoluminal salpingitis. Bilateral tubal ligation carried out for definitive family planning can constitute a special category of tubal infertility incase of the need for reversal of tubal ligation. Location of the lesions affecting the tube are, endoluminal (affecting mucosa and cilia), intramural (affecting the muscle) or peritubal or pelvi-peritoneal (external tubal compromise). They cause anatomic and physiological compromise of tubal functions of ovum pick-up, fertilization and zygote transport between the ovary and the uterus in the normal process of procreation<sup>7,8</sup>.

### Laparoscopy and Hydrotubation

Laparoscopy facilitates easy visualisation of the external appearance of the fallopian tubes. Instillation of dye through the cervix with a cannula intravaginally allows visualisation of tubal patency. In the absence of dye flowing from the fimbrial end of the fallopian tube, the tube is deemed to be blocked. False positives have been attributed to tubal cornual spasm. Visible external peritubal adhesions can be due to previous pelvic infection, endometriosis or surgery. Some studies have suggested an inverse relationship between severity of periadnexal adhesions and pregnancy outcome; others have not. Several classifications for periadnexal adhesions have been devised, including that of the American Fertility Society (AFS). There seemed to be a better correlation between periadnexal adhesions and pregnancy outcome when salpingostomy was included in the classification criteria. It was felt that the status of the tubal mucosa was the most powerful prognostic factor in predicting pregnancy outcome. Women who are thought to have other co-morbidities should be offered a laparoscopy and dye so that tubal and other pelvic pathologies can be assessed at the same time.<sup>2</sup>

### Hysteroscopy

Hysteroscopy is a well established diagnostic and operative technique widely used to diagnose and treat many common gynecological abnormalities related to the uterine cavity. It also constitutes an important diagnostic step in the treatment of infertility. Hysteroscopic procedures are highly appreciated mainly for their minimal invasiveness, suitability for office gynecology, cost effectiveness and safety<sup>3</sup>. Tubotubal anastomosis and tubal implantation conventionally performed for proximal tubal obstruction are prolonged, tedious and skilled surgical procedures and have the disadvantage of postoperative adhesion formation. Whereas, transcervical hysteroscopic tubal cannulation avoids the need for incisional surgery and the whole procedure is performed in a simple manner under magnified view with a certain degree of skill. Advantages of combined hysteroscopic and laparoscopic approach are proper assessment of the distal tubes and ovaries, the elimination of spasm as a factor, absence of radiation, more precise application of instruments and confirmation of achievement of tubal patency during the procedure<sup>4</sup>.

### Fallopscopy

Fallopscopy is a transvaginal microendoscopic technique to explore the human Fallopian tube from the uterotubal ostium to the fimbrial end. Fallopscopy provides a unique possibility to visualize endotubal disease and may be used therapeutically for removal of debris and for cutting down filmy intraluminal adhesions<sup>1</sup>. The interior of the fallopian tube is the last frontier in the exploration of the anatomy of the pelvic organs in the field of reproductive surgery. Fallopscopy allows exploration of the cornua, isthmus and ampullary areas of the interior of the fallopian tubes. Two commercial methods are available: the linear everting catheter system and co-axial guidewire system. Both systems use a very small-diameter, flexible telescope of 0.5 mm through a flexible and atraumatic catheter. Cannulation is considered a success when no resistance was met, while tuboplasty is considered successful when resistance was negotiated with the catheter<sup>2</sup>.

### Methodology

**Materials and data collection:** The study was carried out through a literature search using the electronic (virtual) library of the following search engines: Google, Springer online, high wire press, Pubmed and other linked references.

**Inclusion criteria:** all studies that were available on line from these search engines on endoscopic evaluation and treatment of tubal infertility.

## Discussion

These minimal access procedures have completely changed the diagnostic approach and treatment of tubal infertility. The fallopian tube can now be examined directly in real time under magnification and in its natural habitat under physiological conditions contrary to HSG<sup>9</sup>. Exploration of the tube is now more extensive with more dynamic investigative manouvres and less risks, incidents and accidents. This is partly due to the fact that investigations most often are carried out under improved anaesthesia. Accessory and complementary procedures like chromotubation under direct vision have become safer, producing more information on the functional status of the oviducts. The advent of proper instrumentation and techniques provided the critical catalyst in making endoscopic diagnosis such an invaluable tool as it is today in the management of tubal infertility. Various forms of endoscopic gadgets like hysteroscopes are valuable in exploring the uterine cavity and the proximal (uterine) ostium; falloposcopy to do a dynamic exploration of the fallopian tube along its whole length using either the linear everting catheter system or the coaxial falloposcope. The external aspect of the tube and its regional anatomy can be viewed from different angles with the aid of the laparoscope while at the same time monitoring the other procedures to avoid accidents and incidents. Chromotubation carried out under direct and magnified vision has since replaced contrast injection during HSG. The ability to simultaneously carry out the different forms of genital endoscopic examination allowed for a more detailed, complete and credible diagnosis<sup>10-12</sup>.

Magnification in endoscopic diagnosis has significantly reduced inter-observer variation in describing lesions unlike in clinical and biological investigations and HSG<sup>13</sup>. All of the above characteristics and inherent advantages has positioned endoscopy as the gold standard in the diagnostic management of tubal infertility<sup>14,15</sup>. Catalano GF et al using salpingoscopy showed that the state of the tubal mucosa was the most important prognostic factor for fertility with rates ranging between 60 and 70%<sup>16</sup>.

Endoscopy has also been of tremendous assistance to biological diagnosis by offering the possibility of more precise and targeted sampling of sites and suspected lesions. Biopsies can be made of lesions suspicious of endometriosis, TB among many other possibilities. Different types of tissues and specimens have been taken for histology and various immuno-histochemical analysis in order to establish or confirm clinical or biological diagnosis<sup>17,18</sup>. Research of this nature has lead to a better understanding and diagnosis of cases formerly classified as 'unspecified infertility'. Most cases have been found to be undiagnosed tuboperitoneal infertility such as asymptomatic tubal or peritubal TB and endometriosis<sup>7,17-19</sup>).

Improvements in diagnosis has come along with better case definition, staging and classification in tubal infertility. Biological, anatomic and more importantly functional lesions can be well defined. This allows for an appropriate therapeutic decision with the goal of optimizing outcome at the best cost-effective ratio and in record time.

The various forms of tubal pathology causing infertility can be treated with minimal access procedures with promising results. Laparoscopic surgical treatment of endometriosis associated infertility has produced high success rates<sup>20,21</sup>. Laparoscopic adhesiolysis, tubal recanalisation without resection using various methods such as chromopertubation, falloposcopic dilatation and recanalisation<sup>22</sup>. Laparoscopy assisted tubal reanastomosis a tubal reversal procedure has shown good fertility outcome rates with low ectopic pregnancy rate<sup>23-26</sup>. Laparoscopy is very valuable in artificial reproductive techniques such as IVF when there is irreversible tubal damage for convenient and safe oocyte retrieval<sup>27</sup>.

The conventional diagnostic modalities for evaluation of tubal infertility include; clinical evaluation, biological work-up, sonoHSG and HSG<sup>28</sup>. These methods have low sensitivity and specificity rates with low predictive values<sup>29</sup>. They lack adequate information on different aspect of tubal infertility like endometriosis, tubal occlusion, peritubal adhesion and endoluminal microlesions<sup>28,30,31</sup>. However the passage of contrast medium under high pressure during HSG has been shown to have therapeutic effect on some form of tubal occlusion and recent meta analysis recommends flushing the tubes with oil soluble media before contemplating more invasive therapies<sup>32</sup>. The advent of endoscopy came along with the possibility of diagnosis under direct view and magnification at close range. Dynamic exploration has become possible with instantaneous results as opposed to the other forms of diagnostic procedures. Time was needed to process Xray films before interpretation and results of biological investigations might take days to be available. Delays between diagnosis and treatment no longer depend on on delays in diagnostic results. Endoscopic diagnostic procedures can be applied to all phase of tubal disease with potential risk of infertility from the acute to the chronic and consolidated state<sup>33,34</sup>. With endoscopy, endoluminal, mural and extra-tubal lesions can be simultaneously explored with a better diagnostic mapping of lesions<sup>11</sup>. Tubal investigations are more exhaustively done within a shorter time lapse during which time complementary procedures can be carried out to improve on clinical and biological diagnosis. This leads to better diagnosis, gain in time, earlier therapeutic decision, cut in costs and patient convenience. All these advantages justify the onestop shop model of infertility management being put forth by some authors<sup>35,36</sup>. Hysteroscopy can serve as a means of proximal tubal (ostium) occlusion treatment. Falloposcopy in itself can recanalise some minor case of occlusion or can serve as a guide to direct tubal catheteric recanalisation under laparoscopic guidance<sup>36</sup>. Studies have shown successful recanalisation of up to 50% with significantly increased pregnancy rate<sup>37</sup>

Comparing the advantages of laparoscopic interventions with open surgery in terms of intrauterine conception rates. Some studies have reported no significant advantage but a vast majority have found a relative advantage<sup>38,39</sup> while a few other have reported a clear margin in favour of operative laparoscopy<sup>26,39,40</sup>. In a meta-analysis, Ahmed et al showed that there was a significant advantage of laparoscopy over laparotomy in distal tubal surgery<sup>41</sup>. The debate is however settled in favour of operative laparoscopy by the other nonspecific advantages of minimal access procedures. These include: safety, reduced cost, reduced rate of transfusion, reduced convalescence time and hospitalisation days, improved cosmetic effects and patient satisfaction<sup>42-45</sup>).

Laparoscopic adhesiolysis, tubal anastomosis, neosalpingostomy and endometriotic surgery can be performed with improved prognosis<sup>46</sup>. In extreme cases only fit for IVF, coeleoscopy has been found to be advantageous over other methods of oocyte retrieval<sup>27</sup>. Falloposcopic GIFT has been found to be safe, efficient and less invasive alternative to laparoscopic transfer<sup>47</sup>. The field of minimal access surgery has continued to grow with improved technology, Robotic endoscopy and NOTES are gaining more attention with promising results.

#### Conclusion

Management of tubal infertility can be safely and effectively carried out with endoscopic procedures with better results compared to the laborious and time consuming conventional diagnostic modalities. Acquisition of minimal access surgical skills by gynaecologist will increase access of infertility patients to these procedures with the benefits of improved diagnosis, better treatment options, faster recovery, better patient satisfaction and reduced healthcare cost.

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