ECRONICON OPEN ACCESS

EC GYNAECOLOGY
Review Article

Female Genital Tuberculosis, Diagnostic and Therapeutic Challenges

Chhabra S*

Emeritus Professor, Obstetrics Gynaecology, Mahatma Gandhi Institute Of Medical Sciences, Sevagram, Wardha, Maharashtra, India

***Corresponding Author:** Chhabra S, Emeritus Professor, Obstetrics Gynaecology, Mahatma Gandhi Institute Of Medical Sciences, Sevagram, Wardha, Maharashtra, India.

Received: January 09, 2018; **Published:** March 27, 2018

Abstract

Introduction: One in five cases of tuberculosis present as extrapulmonary TB (EPTB), pose major diagnostic, management challenges. Before HIV epidemic, 15% new TB cases had EPTB, 30% urogenital tract TB. Genital TB in women is not uncommon, remains undiagnosed/diagnosed late, notorious for evading diagnosis.

Objective: Share challenges in diagnosis, therapy of genital tuberculosis.

Methodology: Simple review of literature about GTB in women was done by using various search engines.

Results: Literature revealed GTB incidence varied depending upon geographical location, diagnostics, 0.69% from developed countries to 19% India, mostly secondary manifestation of primary pulmonary tuberculosis in 10% PPT cases. Fallopian tubes, initial site of focus affected in 99 - 100%, usually bilateral, endometrium 50 - 60%. Recent studies reported, endometrium more commonly involved, TB vulva vagina in 1%, rarely primary site, sexually transmitted as cervix. Mode of spread was reported as hematogenous/lymphatic, occasionally direct intra peritoneal continuity too. GTB was described as disease of young 80 - 90%, diagnosed between 20 - 40 years with little correlation between complaints/findings. Chest X-Ray, ultrasonography, hysterosalpingography, computed Tomography, Magnetic Resonance Imaging, laparoscopy, laparotomy were needed if histopathology of endometrial biopsy was not conclusive. Main therapy advocated was medical, (isoniazid, rifampicin, ethambutol, pyrazinamide), many regimens. Follow up endometrial sampling revealed cure. Sometimes surgery was been needed. Pregnancy after GTB was uncommon, even with *in vitro* fertilization.

Conclusion: GTB in women continues to be not uncommon, undergoing worrying recrudescence. Research for early diagnosis, effective medical, surgical therapy with preservation of reproductive capability must continue.

Keywords: *Genital Tuberculosis; Women; Diagnostic; Management Difficulties*

Introduction

One third of the world's population is infected with mycobacterium tuberculosis (MTB). Almost 50% of the population in developing countries is affected by TB. Earlier researchers had estimated that 30 million people were having active TB, and 7 - 10 million people used to die of TB each year [1,2]. Later WHO reported that globally 9.2 million new cases were reported and 1.7 million deaths occurred due to TB annually. TB has become epidemic with emergence of HIV/AIDS globally with multidrug resistant strains of the microbes [3]. In a recent report WHO [4] reported that TB was the leading killer of the people who were HIV infected. A total of 9.557 TB cases (a rate of 3.0 cases per 100,000 persons) were reported even in the United States in 2015. In 2015, around the world 10.4 million people became sick with TB and there were 1.8 million TB-related deaths [5]. The increase in TB cases has been witnessed not only in Africa and Asia, but in European countries also and has become an important cause of morbidity and mortality worldwide [6,7]. India has nearly one fifth of the global burden with more than 20,000 people developing TB, and more than 1000 died from TB as per RNTCP status report 2001 [8]. WHO [9] reported that almost one half of the population of India had TB and that one person died every minute from TB. The reported incidence of TB in India has been 168/Lac and 28 deaths/lac population.

Objective

Share challenges in diagnosis and therapy of genital tuberculosis.

Methodology

Simple review was done to know diagnostic and therapeutic challenges of genital tuberculosis in women.

Results

One in five cases of TB presented as extrapulmonary TB (EPTB), posing major diagnostic and management challenges with a variety of clinical and investigative features depending on the organ/site involved. Before the HIV epidemic, approximately 15% of newly reported cases of TB had extra pulmonary involvement [10]. Approximately, 30% of cases of extra-pulmonary tuberculosis involved the urogenital tract [11]. In India, genital TB (GTB) is not uncommon but remains undiagnosed or is diagnosed late. A high degree of suspicion aided by intensive investigations are required to reach the diagnosis. It has a known propensity for dissemination from its primary site. Thus, TB can mimic a number of other disease entities. It is essential to be familiar with the various features. Despite the enormous burden of disease, current diagnostics are still woefully inadequate. Amongst the female genital disorders, GTB is the most baffling disorder, because of its varied presentation. It tends to manifest as menstrual irregularities, infertility, chronic pelvic or lower abdominal pain or lump etc. GTB is mostly acquired by haematogenous route. It may remain silent and diagnosed during or after pelvic surgery, sometimes after histopathological examination of specimen sent with some other diagnosis, Decades back Schaefer had said that genitourinary tuberculosis was mostly a secondary manifestation of primary pulmonary or abdominal TB and the same remains true even now [12]. The true incidence of GTB is not known owing to its subtle presentation. Approximately 5 - 10% of females who present to infertility clinics worldwide have GTB. It is believed to cause infertility in 44 - 74% of the women affected [13,14]. Although the spread of TB from primary infection to the pelvis usually occurs early, detection of GTB is delayed because disease remains silent and is focal. Endometrium, material usually available and used for diagnosis is involved only in little more than half cases. So, GTB is notorious for evading diagnosis. Female GTB is typically a disease of young women and its occurrence in menopausal/postmenopausal women is believed to be uncommon.

Reported incidence of GTB varies greatly depending upon the geographical location and available diagnostic technologies. Incidence as low as 0.69% from developed countries and as high as, 19% in India have been reported [15]. In a study GTB represented 15 - 20% of extra pulmonary TB [16]. The true incidence of GTB cannot be determined accurately in any population because it is estimated that many patients are asymptomatic and the disease is discovered incidentally as was reported years back also [17]. Estimated incidence in India is 5 to 19% of the women presenting to infertility clinics. Decades back the reported incidence of GTB was 5.6% in Scotland [18], 0.69% in Australia [12], 0.07% in the United States [19], less than 1% in Finland [20], 4.2% in Saudi Arabia [21], and 19% in India [22]. In a recent study, female genital TB accounted for 1.25% of all tuberculosis patients [23].

GTB, mostly a secondary manifestation of primary pulmonary tuberculosis (PPT) may develop in about 10% of PPT cases. Fallopian tube is usually the initial site of focus and is affected in 99 - 100% cases and usually both tubes are involved. Endometrium is involved in 50 - 60% of cases. A few recent studies have reported, endometrium to be the most commonly involved site. Ovarian involvement occurs in 15 - 25% cases, cervix may be involved in 5 - 15% and is usually a late manifestation of endometrial, tubal infection. In a study Patel [23] reported the highest incidence between 21 - 30 years of age, though the patients diagnosed with GTB were of 18 - 60 years and of 21 cases of GTB, endometrium was involved in 16, fallopian tubes 4 and cervix in one. Rarely it may be seen as an apparently isolated primary lesion from infected semen. Tuberculosis of vulva and vagina occurs only in 1% cases, however, rarely vulva/vagina may be the primary sites due to the same reasons as in the cervix.

Various studies showed GTD as a cause of infertility in 1 - 17% of the cases, around 1% in the developed countries and 18% in India [12,24]. Roy., *et al*. [25] reported 5 - 10% of infertility cases with GTB and of all the cases of GTB, 45 - 50% presented with infertility. In another study laparoscopy indicated definitive GTB in 9.1% and probable GTB in 37.4% of the 118 women being treated for infertility

and after treatment, 22.9% conceived without *in vitro* fertilization. Of these women, 74.1% had a positive endometrial aspiration (EA), polymerase chain reaction (PCR) and 59.3% had positive laparoscopy finding. A quarter of the women received ATT solely on the basis of the PCR results and 31.0% of conceived. No single test could detect all cases of GTB [15]. Tripathy [26] reported the incidence of infertility 58% in cases of GTB. All patients were symptom free. Risk factors not conducive to pregnancy were secondary amenorrhea, no endometrium on curettage, and negative chromopertubation. The conception rate was low, 19.2%, the live birth rate being still low, only 7.2%.

The mode of spread is usually hematogenous or lymphatic and occasionally by way of direct continuity with an intra-abdominal or peritoneal focus [12]. Often there is little or no evidence of infection at the primary site. Though it is not a sexually transmitted disorder, occasionally vulval, vaginal and cervical TB may be because of ascending infection from infected semen [27].

Since decades, classically GTB has been described as a disease of young women with 80-90% of patients diagnosed first time between the ages of 20 and 40 years [12] but GTB may occur in women of any age. A peripubertal girl with primary amenorrhoea or postmenopausal woman with vaginal bleeding, both need to be suspect. The variety of presentation, focal pathology in different organs, etc. make it notorious for evading diagnosis. The symptomatology and the clinical picture are so variable that symptoms or signs or investigations alone may not be diagnostic or it may come as a surprise while dealing with some other condition [28]. The vagaries of presentation, focal pathology in different organs etc. make it notorious for evading diagnosis. Unless specially looked for the diagnosis is often missed. Moreover it is believed that there may not be any clinical evidence that the fallopian tubes are involved, most common site of involvement [19,29], but minimal or subclinical tuberculosis may be present. In a study only 50% of cases were diagnosed without surgery [30]. Many a times a high degree of suspicion aided by intensive investigations are required for diagnosis. The diagnosis is seldom suggested by history, physical examination or investigations. Infertility, amenorrhea and other menstrual disturbances are said to be common modes of presentation and incidence of GTB in infertility patients in India to be upto 19% 5 - 10% [12]. Sometimes there is over diagnosis too [31].

Sometimes there is little correlation between the presenting complaints and physical findings, however when a pelvic problem does not conform to expected rules, the first consideration should be ectopic pregnancy and the second, GTB. GTB should be strongly through of when salpingitis occurs in a woman who is virgin. The fallopian tubes are the first and most commonly affected part of genital tract followed by endometrium, ovary, cervix, vagina and vulva. Adhesions between tubes, ovaries, omentum, intestines, liver, and diaphragm are common findings (Fitz Hugh Curtis syndrome) [32]. The clinical picture is so variable that single symptoms or signs or investigations may not be help. There may not be any clinical evidence that the fallopian tubes (most common site of involvement) are involved but, minimal or subclinical disease may be present.

No physical sign in systemic or abdominal or pelvic examination is characteristic. Physical examination may be entirely normal in 30 to 50% cases [33]. In addition many women are completely asymptomatic (15 of 30%). However, four major presenting complaints have been described with varying frequencies infertility, abnormal vaginal bleeding, pelvic pain and menstrual abnormalities. Constitutional symptoms such as fever, sweating, anorexia and weight loss are not common. GTB can present with adnexal masses, abdominal lump with ascites, mimicking the presentation of ovarian malignancy or with vaginal discharge mimicking cervical cancer [34]. To further confuse the picture the serum CA - 125 levels may be elevated as well. Around 20% women have tubo-ovarian masses. The diagnosis is sometimes made only after unnecessary laparotomy done even after high imaging technology use. There may be multiple adhesions in the fallopian tubes, ovaries, bowel, omentum, and liver [35-39]. During a study, out of 3088 cases of TB based on the standard pathological criteria of tissue specimens, there were 41 cases of GTB. In 75.6% cases GTB was diagnosed while evaluating for infertility. GTB accounted for 1.32% of all patients with tuberculosis. TB endometritis was detected in 72.03%, tubal involvement was in 34.03%, ovarian in 12.9% and cervical in 2.4% of the patients [40]. The study by Patel revealed that patients presented with infertility, out of 21 cases, 7 demonstrated typical epithelioid granulomas and rest had atypical tuberculous lesion [23]. Mondal [34] reported pelvic/abdominal pain (50 - 55%), menstrual disturbances in (20-25%). However women with other gynaecological symptoms could also have tubercular aetiology. Actually in women with distended bowel adherent, injury may occur during laparoscopy, even laparotomy. It can also mimic disseminated carcinomatosis. Ultrasonographic examination of the abdomen, pelvis and computerized tomography or magnetic resonance imaging may differentiate it from ovarian malignancy [41], but the final diagnosis is after laparotomy, sometimes after histopathology of specimen sent [42].

The frequent complaints with which women can present are chronic low grade lower abdominal or pelvic pain (25 - 50%) [43], abnormal uterine bleeding (10 - 40%), menorrhagia, menometrorrhagia, intermenstrual bleeding. Oligomenorrhea and post-menopausal bleeding may be presenting complaints [33,44], 10 - 40% of patients reported AUB [12]. Other symptoms may be amenorrhoea, vaginal discharge, abdominal swelling [45]. Post-menopausal GTB is relatively uncommon. In a study done decades back Sutherland., *et al*. [45] had reported that only 2.2% cases of diagnosed GTB were postmenopausal. In a study of women with postmenopausal bleeding tuberculosis of endometrium was detected only in 0.1% cases [47]. They may demonstrate adnexal masses which may vary in size from slight thickening and irregularity of tube to a large tubo ovarian mass with varied consistency. Lower abdominal or pelvic pain is seen in approximately 25 - 50% patients. The pain is usually chronic and of low intensity but may be severe sometimes. There is almost uniform initial involvement of the tubes with subsequent dissemination to other genital organs and peritoneum. In 25 - 50% of cases of GTB the fallopian tubes remain patent.

Tuberculous peritonitis is commonly seen with genital tract involvement (45%) and may also be associated with rupture of a caseous abdominal lymph node or less frequently with spread from intestinal focus. It is responsible for extensive adhesions encountered in cases of pelvic disease. Fortunately, the association of tuberculous salpingitis and ectopic pregnancy is rare as there is high incidence of tubal blockage and also, the diseased endosalpinx is unsuitable for implantation of the fertilized ovum.

In a study by the author [28] most of the patients were between 20 to 30 years of age and had infertility, but some cases had many births. However the diagnosis came as a surprise in some cases where work up was being done with clinical diagnosis of leiomyoma or ectopic pregnancy or even malignant ovarian tumor. In a post-menopausal woman who presented with adenexal mass, ascites and raised CA -125, clinical features typically were of ovarian malignancy but after histopathology of various sites it was abdominal TB and GTB. Another middle age woman had clinical appearance of abdominal TB/GTB but all the work suggested Ovarian cancer. But diagnosis of abdominal TB and GTB could be done after laparotomy and multiple biopsies. Other researchers have also reported that exploratory laparotomy should be considered when the diagnosis remained in doubt. In a study around 20% women with tubo ovarian masses, the diagnosis was made only after unnecessary laparotomy [34].

It is not possible to demonstrate (MTB) in every case after clinical diagnosis. Therefore, one has to use various diagnostics like Chest X-Ray, PPT, ultrasonography (USG), hysterosalpingography (HSG), laparoscopy and laparotomy. If the histopathology of endometrial biopsy is not conclusive, Computed tomographic (CT) and magnetic resonance imaging (MRI) are also carried out. CT Scan may reveal low-density ascites, uncommon patterns of adenopathy, presence of multiple pelvic lesions, hepatic, adrenal and splenic lesions. Newer investigations such as ELISA and PCR have also been applied with satisfactory results. Chest X-ray usually has either no finding, or evidence of old pulmonary complex in 10-50% of cases. The most probable explanation is that a clinically undetected lung disease underwent spontaneous resolution, later with a type of bacteraemia to which the tubes alone seemed to be responsive, may be because of their structure, blood supply or defence mechanism or genetic receptivity. Association of active pulmonary TB with GTB is rare. Value of PPD is only to increase the index of suspicion.

Bilateral, predominantly solid, adnexal masses containing scattered small calcifications on USG are highly indicative. HSG may reveal a characteristic tubal pattern, but it is likely to result in exacerbation of the disease and is therefore, contraindicated in suspicious or known disease. The finding of bilaterally blocked fallopian tubes, often with multiple strictures giving a beaded appearance is consistent with GTB. Tubes may be patent in more than 30% cases with tuberculous endometritis. The uterine cavity may be classically shrivelled and deformed with intrauterine adhesions, giving a picture of Asherman's syndrome on hysteroscopy. Laparoscopy with directed biopsies of suspicious areas may be helpful if less invasive methods fail to provide the needed diagnostic information. Laparoscopy is now a well recognized procedure in the diagnosis in infertile women. It can reveal presence of miliary granulomas, whitish yellow or opaque plaques surrounded by hyperaemic areas over the fallopian tubes and uterus in acute stages. In chronic stages, the tubes show nodular salpingitis, patchy salpingitis, hydrosalpinx, caseosalpinx, or adhesions. But caution is essential because of the possibility of perforating a loop of

adherent bowel. Laparoscopy, PCR have been reported to be positive in 50% of patients with findings suggestive of GTB. However PCR is positive in patients with normal laparoscopic findings also. The only source of material generally available for histopathology and culture is endometrium (or menstrual discharge) and endometrium is affected only in 50 - 60% cases and this further limits the cases in whom definite diagnosis of GTB can be made. Best time to perform endometrial biopsy is shortly before the menstruation as lesions are likely to be close to surface of endometrium. Negative endometrial biopsy does not rule out the pelvic involvement since sampling errors are common, focal disease may not be touched and disease may have involved other pelvic organs without associated endometritis. Culture remains the gold standard, but it can take up to 8 - 10 weeks for results, and it has been noted that the sensitivity is variable depending on the host and site.

In a study by Gupta., *et al*. [39] of 40 infertile women with GTB endometrial aspiration showed tubercular endometritis with positive acid-fast bacillus culture in one and positive PCR results in 9. Laparoscopic examination revealed abnormally dilated, tortuous, and blocked fallopian tubes, peritubal and periovarian adhesions, omental adhesions and bowel adhesions. Hysteroscopy revealed flimsy intrauterine adhesions. In a study GTB was diagnosed with laparoscopy and confirmed by tissue biopsy in 5.7%. Visual laparoscopic findings and direct tissue biopsy had the highest sensitivity and specificity (92 - 94%, respectively) followed by PCR (83 - 85%) and lastly endometrial biopsy (75 - 80%) for diagnosis of GTB [48]. In a study of 151 women who had tubal factor infertility, 61 cases were investigated for GTB 47 (37%) had GTB. Of 61 cases investigated for GTB 34 (55.7%) were positive for TB and only 15 of 34 were PCR positive. Endometrial TB was diagnosed in 82.9% [49].

Most studies have found a higher diagnostic yield with histopathological examination of endometrium than culture and unsupported histopathological evidence is acceptable. Also it is thought to be the cheapest, easiest and quickest method. But shortcomings of diagnosis by histology alone are also well recognized and an irrefutable diagnosis of GTB can only be made by the isolation of MTB. Culture on Lowenstein - Jensen medium and Guinea pig inoculation have been used to grow MTB. Both methods take 6 - 8 weeks to provide results. Further there are cases with positive culture and negative histopathology and only in few both are positive [50]. Both methods of diagnosis are complementary. If the disease is confined to the fallopian tubes, most common site, even laparotomy may be negative and diagnosis may only be after tubal biopsy histopathology. All the modalities of available investigations do help in the diagnosis. None of the immunological tests help in definitive diagnosis of tuberculosis at early stage. TB can also be diagnosed on Fine needle aspiration cytology (FNAC) and detection of acid fast bacilli (AFB) or caseating granulomas in smears [51].

A study from South Africa found an incidence of 6% culture positive tuberculosis in an infertile population. Botha [52] reported that many patients presented with a symptom complex similar to that of ovarian carcinoma, i.e. abdominal distension, pelvic tumour and ascites, which may easily be confused with ovarian carcinoma. Sixty two cases of bacteriologically positive pulmonary tuberculosis were studied by Tripathy and tuberculous endometritis was detected in 4 women [26]. Bhanothu., *et al*. [13] did a study using the modern molecular method, gene polymorphism distribution of IFN- γ genotypes between patients and controls had statistical disproportion. This study suggested that IFN-γ +874 T to A polymorphism have an etiological association with susceptibility of FGTB. This study may help in timely detection of FGTB along with gene polymorphisms wherever applicable, in selection of satisfactory therapy and in anticipation of the further progression of the disease.

Treatment

Medical/Surgical

Medical treatment is the main mode of therapy in GTB. Different regimens have been successful in alleviating symptoms of abnormal bleeding and pain. Follow up endometrial sampling often revealed cure. Worldwide, 9.9% of the cultured bacteria were resistant to first line drugs and 1.4% were MDR - TB [53]. Early diagnosis, before extensive damage occurred, followed by appropriate treatment was associated with better outcome for fertility and cure also. Multiple drug therapy utilizing isoniazid, rifampicin, ethambutol and pyrazinamide remained the main medical treatment. Under 'DOTS' for the GTB, (extra - pulmonary tuberculosis mild type), Category Ill treatment has

been advocated which included 2 or 3 months of Isoniazid + Rifampicin + Pyrazinamide in intensive phase and 3 or 4 months (Isoniazid + Rifampicin) in continuation regimen recommended total 6 months. Cases of a serious nature deserve Category I regimen which included Isoniazid + Rifampicin + Pyrazinamide + Ethambutol in intensive phase 2 months followed by Isoniazid + Rifampicin 4 months.

The role of surgery in the modern times is clearly as adjunctive therapy. Tuboplasty is not advocated as surgical therapy as even if anatomical continuity is achieved function is lost, fistulae are known. Commonly cited indications for surgery include persistent or re-current disease, presence of non-healing fistulae, and multi-drug resistant TB. Surgery is usually not recommended but total abdominal hysterectomy with bilateral salpingo-oophorectomy may be required in women in later ages who continue to be symptomatic inspite of treatment not responding to medical treatment.

Pregnancy after GTB is uncommon few do conceive and still few have taken home babies even with *in vitro* fertilization. Varma [54] earlier reported that live births after GTB were very rare with over poor fertility outcome. Eryani [49] reported conception rate after ATT was 12.8%. If tuberculous endometrium is missed and woman conceived with IVF baby may be born with tuberculosis. ATT improves laparoscopic findings in FGTB with infertility. However, advanced fibrotic lesions (e.g. pelvic and perihepatic adhesions, bilateral blocked tubes) do not improve with ATT [14].

Conclusion

GTB continues to be not a uncommon disorder in women. With HIV, AIDS the incidence is increasing. GTB is now undergoing a worrying recrudescence. So the disease needs renewed interest. Early diagnosis and appropriate treatment not only relieve the symptoms but there are more chances of fertility. Recognition and understanding the spectrum of imaging features help in the diagnosis of GTB. New tools in the diagnostic armamentarium are urgently required for the rapid diagnosis of GTB and monitoring of GTB treatments, and to gain new insights into pathogenesis. The roles of several imaging modalities for the typical and atypical imaging features of EPTB diagnosis and management of EPTB need to be researched [55]. We need to have an in depth knowledge of the pathology, the diagnostic means with which to discover it early and the correct therapeutic instruments to overcome. Research for early establishment of diagnosis, effective medical and surgical therapies with preservation of reproductive capability of the affected must continue.

Bibliogrpahy

1. Ellner J., *et al.* "Accelerated course of human immunodeficiency virus infection after tuberculosis". American *Journal of Respiratory and Critical Care Medicine* 151.1 (1989): 129-135.

2. Dhillon SS., *et al.* "Genital tuberculosis: Case report and literature review". *WMJ* 89.1 (1990): 14-17.

3. Joseph P., *et al.* "Multi-drug resistant tuberculosis at an HIV testing center in Haiti". *AIDS* 20.3 (2006): 415-418.

4. World health organization. "Global tuberculosis report" (2014).

5. Trends in Tuberculosis (2015).

6. Alrajhi AA and Al-Barrak AM. "Extrapulmonary tuberculosis, epidemiology and patterns in Saudi Arabia". *Saudi Medical Journal* 23.5 (2002): 503-508.

7. Zumla A. "The white plague returns to London-with a vengeance". *Lancet* 377.9759 (2011): 10-11.

8. Nagaraja V., *et al.* "Is Awareness of Dots Among Medical Practitioners A Worry? A Developing Nation Scenario". *International Journal of Collaborative Research on Internal Medicine and Public Health* 4.5 (2012): 555-560.

9. World Health Organisation. "WHO report 2006. Global tuberculosis control: surveillance, planning, financing". WHO/HTM/TB/2006.362. Geneva, Switzerland: WHO (2006).

10. Hopewell PC. "A clinical view of tuberculosis". *Radiologic Clinics of North America* 33.4 (1995): 641-653.

11. Kim SH. "Urogenital tuberculosis". In: Pollack HM, Mcclennan BL, DyerRB, Kenney PJ, Clinical urography 2nd Philadelphia, PA Saunders (2000): 1193-1228.

12. Schaefer G. "Female genital tuberculosis". *Clinical Obstetrics and Gynecology* 19.1 (1976): 223-239.

13. Bhanothu V., *et al*. "Comparative investigation of female genital tuberculosis gene polymorphism". *International Journal of Current Research* 4.1 (2012): 034-040.

14. Sharma JB., *et al.* "Comparative study of laparoscopic abdominopelvic and fallopian tube findings before and after antitubercular therapy in female genital tuberculosis with infertility". *Journal of Minimally Invasive Gynecology* 23.2 (2016): 215-222.

15. Kulshrestha V., *et al.* "Genital tuberculosis among infertile women and fertility outcome after antitubercular therapy". *International Journal of Gynecology and Obstetrics* 113.3 (2011): 229-234.

16. Rajameheshwari. "Pelvic tuberculosis". *International Journal of Medical Microbiology* 27.4 (2005): 361-363.

17. Goldom G and Marella VK. "Genitourinary manifestations of tuberculosis". *Urologic Clinics of North America* 30.1 (1985): 111-121.

18. Sutherland AM. "Genital tuberculosis in women". *American Journal of Obstetrics and Gynecology* 79.3 (1960): 486-497.

19. Klein TA., *et al.* "Pelvic tuberculosis". *Obstetrics and Gynecology* 48.1 (1976): 99-104.

20. Punnonen R., *et al.* "Female genital tuberculosis and consequent infertility". *International Journal of Fertility* 28.4 (1983): 235-238.

21. Chattopadhyay SK., *et al.* "The pattern of female genital tuberculosis in Riyadh, Saudi Arabia". *British Journal of Obstetrics and Gynaecology* 93.4 (1986): 363-371.

22. Bateman BG., *et al*. "Genital tuberculosis in reproductive age women". *The Journal of Reproductive Medicine* 31 (1986): 287.

23. Patel S and Dhand P. "A hospital based study on female genital tuberculosis in Central India". *International Journal of Medical Research and Review* 4.2 (2016).

24. Muir R. "Trends of male factor infertility, an important cause of infertility: A review of literature". *Journal of Human Reproductive Sciences* 8.4 (2015): 191-196.

25. Roy H and Roy S. "Use of polymerase chain reaction for diagnosis of endometrial tuberculosis in high risk subfertile women in an endemic zone". *The Journal of Obstetrics and Gynecology of India* 113.3 (2011): 229-234.

26. Tripathy SN. "Laparoscopic Observation of pelvic organs in pulmonary tuberculosis". *International Journal of Gynecology and Obstetrics* 32.2 (1990): 129-131.

27. Siegler AM and Kontopoulous V. "Female genital tuberculosis and the role of hysterosalpingography". *Seminars in Roentgenology* 14.4 (1979): 295.

28. Chhabra S. "Genital Tuberculosis- A Baffling Disease". *The Journal of Obstetrics and Gynecology of India* 40 (1990): 569- 573.

29. Agarwal R., et al. "Female genital tuberculosis in Ethiopia". *International Journal of Gynecology and Obstetrics* 84 (1987): 241-246.

30. Raut VS., *et al.* "The Mantoux test in the diagnosis of genital tuberculosis in women". *International Journal of Gynecology and Obstetrics* 72.2 (2001): 165-169.

31. Vigi C and Naveen C. "Diagnostic Challenges of Female Genital Tuberculosis". *International Journal of Medical Research and Health Sciences* 6.2 (2017): 34-36.

32. Noor S., *et al.* "Abdomino Pelvic Tuberculosis Versus Advanced Ovarian Malignancy: A Diagnostic Dilemma". *Chattagram Maa-O-Shishu Hospital Medical College Journal* 14.2 (2015): 65-69.

33. Simon HB., *et al.* "Genitourinary tuberculosis: clinical features in a general hospital population". *American Journal of Medicine* 63.3 (1977): 410-420.

34. Mondal SK and Dutta TK. "A ten-year clinicopathological study of female genital tuberculosis and impact of fertility". *Journal of Nepal Medical Association* 48.173 (2009): 52.

35. Penna L., *et al.* "Intra-abdominal miliary tuberculosis presenting as disseminated ovarian carcinoma with ascites and raised CA125". *British Journal of Obstetrics and Gynaecology* 100.11 (1993): 1051-1053.

36. Richards MJ and Angus D. "Possible sexual transmission of genitourinary tuberculosis". *International Journal of Tuberculosis and Lung Disease* 2.5 (1998): 439.

37. Barutcu O., *et al.* "Abdominopelvic tuberculosis simulating disseminated ovarian carcinoma with elevated CA-125 level: report of two cases". *Abdominal Imaging* 27.4 (2002): 465-470.

38. Wise GJ and Marella VK. "Genitourinary manifestations of tuberculosis". *Urologic Clinics of North America* 30.1 (2003): 111-121.

39. Gupta N., *et al.* "Genital tuberculosis in Indian infertility patients". *International Journal of Gynecology and Obstetrics* 97.2 (2007): 135-138.

40. Jahromi B., *et al.* "Female genital tuberculosis and infertility". *International Journal of Gynecology and Obstetrics* 75.3 (2001): 269-272.

41. Bankier AA., *et al.* "Update: Abdominal tuberculosisunusual findings on CT". *Clinical Radiology* 50.4 (1995): 223-228.

42. Andreo T., *et al*. "Abdominopelvic tuberculosis in gynaecology: laproscopical and new laboratory findings". *Australian and New Zealand Journal of Obstetrics and Gynaecology* 106 (2008): 602-603.

43. Sutherland AM. "Genital tuberculosis in women". *American Journal of Obstetrics and Gynecology* 79 (1979): 486.

44. Daly JW and Monif GRG. "Mycobacteria. In Monif GRG (ed): Infectious Diseases in Obstetrics and Gynaecology". 2nd edition. Philadelphia, Harper and Row (1982): 301.

45. Sutherland AM. "The changing pattern of tuberculosis of the female genital tract. A thirty year survey". *Archives of Gynecology* 234.2 (1983): 95-101.

46. Sutherland AM. "Genital tuberculosis in women". *American Journal of Obstetrics and Gynecology* 79 (1951): 486.

47. Schaefer G. "Female genital tuberculosis". *Clinical Obstetrics and Gynecology* 19 (1970): 223.

48. Nezar M., *et al.* "Genital tract tuberculosis among infertile women: an old problem revisited" *Archives of Gynecology and Obstetrics* 280.5 (2009): 787-791.

49. Eryani A., *et al.* "Genital tuberculosis is common among females with tubal factor infertility observational study". *Alexandria Journal of Medicine* 52.4 (2015): 321-324.

50. Chhabra S., *et al.* "Pelvic Tuberculosis Continues to Be A Disease of Dilemma- Case Series". *Indian Journal of Tuberculosis* 57.2 (2010): 90-94.

51. Sah SP., *et al.* "Fine needle aspiration cytology of tubercular epididymitis and epididymo-orchitis". *Acta Cytologica* 50.3 (2006): 243-249.

52. Botha M and Merwe F. "Female genital tuberculosis". *South African Family Practice* 50.5 (2008): 12-16.

53. Ghosh K., *et al.* "Tuberculosis and female reproductive health" *Journal of Postgraduate Medicine* 57.4 (2011): 307-313.

54. Varma TR. "Genital tuberculosis and subsequent fertility". *International Journal of Gynecology and Obstetrics* 35.1 (1991): 1-11.

55. Gambhir P., *et al.* "Imaging in extrapulmonary tuberculosis". *International Journal of Infectious Diseases* 56 (2017): 237-247.

Volume 7 Issue 4 April 2018
© All rights reserved by Chhabra S.