

**Patterns of uterine abnormalities and frequency of tubal blockage on
Hysterosalpingography among women with primary and secondary infertility in
population of Punjab Pakistan.**

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Submitted in the partial fulfillment of the requirements for the Degree of BS Medical Imaging and Ultrasonography, University of Management and Technology, Lahore

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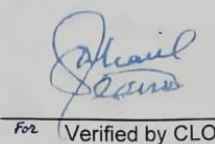
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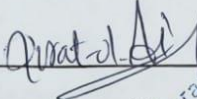
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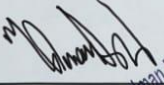

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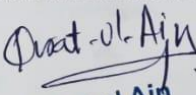
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ABSTRACT

Background: Infertility is a key reproductive health issue that affects millions of couples in the world and has great medical, psychological, and social implications. Among the female factors that are the most significant causes of infertility, structural abnormalities of the uterus and fallopian tubes are considered. Hysterosalpingography (HSG) is an imaging modality that is commonly employed as the first-line tool of assessing the morphology of the uterine cavity and the patency of tubes in infertile women. The objective of the current research was to establish the trend of uterine abnormalities and prevalence of tubal blockage identified on hysterosalpingography in women with both primary and secondary infertile women at Punjab, Pakistan.

Aim: The research will attempt to evaluate the trends of uterine abnormality and incidence of fallopian tube obstruction using hysterosalpingography (HSG) on women with primary and secondary infertility. It will also make a comparison of HSG in the two groups of the Pakistani population.

Methods: It is a cross-sectional study in a hospital and it was done at the Department of Radiology, Fatima Memorial Hospital, Lahore. The study included 175 infertile women aged 18 to 45 years who had HSG to determine their infertility issues through the use of consecutive sampling. It was done based on a structured proforma; data on demographic characteristics, reproductive history, and HSG findings were collected and analyzed through SPSS.

Results: Majority of the respondents were aged between 29 and 39 years (60.6), primary infertility (51.4) was slightly more prevalent than secondary infertility (48.6), with an infertility period of mainly 1-5 years (72.6). Most of them (72) had regular menstrual cycles, with the most frequent ones being 22-25 days (48.6). In 67.4, HSG revealed normal uterine cavity in 67.4 percent and abnormalities in 32.6 percent, congenital abnormalities in 26.3 percent, mostly arcuate uterus (19.4%). In terms of tube status, the right tube was found to be patent in 59.4 and left tube patent 65.1 and both proximal and distal obstructions were noted. The peritoneal spill was bilateral in the 45.7, unilateral in 31.4 and not present in 22.9. In total, abnormal HSG results were more common (74.3%), tubal pathology was the most common (32.6%), combined (21.1) and uterine abnormalities were the most common (20.6%). The type of infertility was significantly correlated with the HSG findings ($p = 0.035$).

Conclusion: The most frequent abnormal observation in infertile women undergoing HSG was found in tubal pathology especially secondary infertility. The results provide a strong case in favor of the use of hysterosalpingography as an effective and inexpensive diagnostic instrument in measuring uterine and tubal factors that cause infertility particularly in resource constrained environments.

Keywords: Infertility, Hysterosalpingography, Tubal blockage, Uterine abnormalities, Primary infertility, Secondary infertility.

DEDICATION

TO

The Greatness of ALLAH ALMIGHTY

The Kindness of HOLY PROPHET MUHAMMAD (P.B.U.H)

We would like to dedicate this work to “Our PARENTS” they raise us up with their countless love and care, provided us with all the facilities of life, encouraged us at every step even at our failures.

Our Respected “TEACHERS”

Whose inspiration and help picked us up like a precious stone of beautiful garden from the countless waste pebbles of seashore. And now we can face the challenges of life.

Our “Caring Siblings” who are always with us and encourage us to face the challenges.

Our “FRIENDS” who are always with us for cooperation and sincerity.

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All praises to Almighty Allah Alone who guides us The Holy Prophet (Peace Be upon Him) and Holy Quran to explain the wonders of the universe. Nothing is deserving of worship except ALLAH, the most merciful and most compassionate, the creator of the universe who blessed us with sympathetic parents, teachers and friends. We express our deepest gratitude to almighty ALLAH for enabling us to complete our research work.

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personality MS. ARIFA MUBEEN, HEAD OF DEPARTMENT of University of Management and Technology (School of Health Sciences).

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Chapter 1

Introduction

1.1 Overview of Infertility

Infertility is a serious reproductive health issue that strikes millions of women across the globe, and it is becoming more and more recognized because of the serious medical, psychological, and sociocultural implications. According to World Health Organization (WHO), infertility is the failure to have conception even after a year of uninterrupted and unprotected sex. It has been estimated that there are 48.5 million couples in the world who have been unable to conceive the first or subsequent pregnancy due to infertility, which occurs in 10-15 percent of individuals at the reproductive age. Infertility has emotional and social effects that go beyond the biological effects; especially in developing nations where parenting is strongly connected with social identity, stable marriages and financial stability. Women in patriarchal societies are frequently blamed as infertile regardless of the cause and thus considered to be stigmatized, suffer psychological distress and disagree with their males. These difficulties represent the importance of early intervention, proper diagnosis and evidence-based treatment plan.

1.2 Classification of Infertility: Primary and Secondary

Clinical classification of infertility is based on two types, namely, primary and secondary infertility, which is the basis of interpretation of the etiological determinants, organization of the diagnostic process, and the interpretation of the findings in the imaging findings.

In a woman who has never conceived, primary infertility is normally considered as the inability to conceive after at least one year of regular unprotected sexual activity. The meaning of secondary infertility, however, is simply failure to conceive after having had at least one pregnancy which may or may not have ended in a live birth, miscarriage, ectopic pregnancy, or stillbirth. The clinical importance of this classification is that primary and secondary infertility typically follow various underlying pathogenesis. Primary infertility is more commonly caused by congenital abnormalities, endocrine disorder, ovulatory disorders, or long-lasting structural abnormalities of the reproductive system. Conversely, secondary infertility is frequently caused by acquired pathology such as pelvic inflammatory disease, postpartum or post-abort infection, prior pelvic or uterine surgery, endometriosis and genital tuberculosis.

1.2 Burden of Infertility in Developing Countries and Pakistan

Infertility is an acute issue in which the incidence is skewed in developing countries that are usually afflicted with avoidable factors including the infection of the reproductive tract, poor maternal health services, and late consultation. In research, both in South Asia and sub-Saharan Africa, it is agreed that secondary infertility is an issue in the regions that is greater than that of primary infertility.

Infertility is a significant but a neglected population health concern in Pakistan. Based on the existing evidence, secondary infertility is associated with more cases of infertility in comparison with primary infertility since infections cause tubal destruction, unsafe maternity care and unavailability of early gynecological treatment during early reproductive life. The large proportion of abnormal hysterosalpingography results in Pakistani women during infertility assessment raises the necessity of indigenous research in this group in order to get topical information.

1.4 Female Factor Infertility and Structural Causes.

In the world, infertility is divided into female factor infertility which comprises half the cases of infertility. Among the female causes, the structural abnormalities of the uterus and the fallopian tubes are of special significance as they directly interfere with fertilization, transportation of embryo, implantation, and pregnancy maintenance.

The abnormalities occurring in the uterus can be both acquired and congenital. Congenital anomalies are caused by altered development of the Mullerian ducts and consists of septate, bicornuate, unicornuate, and didelphys uterus. The acquired abnormalities of the uterus are submucosal fibroids, endometrial polyps, intrauterine adhesions (Asherman syndrome), and distortion of the cavity as a result of infection or surgical injury. One of the most common causes of female infertility is tubal pathology that occurs mostly in the area where inflammatory diseases of the pelvis and genital infections are widespread. Tubal abnormalities consist of unilateral or bilateral tubal occlusion, hydrosalpinx, peri tubal adhesions and salpingitis isthmica nodosa. In Pakistan, Nigeria, Bangladesh and Nepal a number of studies have reported tubal pathology results in 30-55 percent of infertile women though higher in secondary infertility.

In the world, female factor infertility is a half of the cases of infertility. Among the female factors, the structural defects of the uterus and the fallopian tubes are of special significance since

they directly disrupt the fertilization, embryo transportation, implantation, and pregnancy maintenance processes.

The abnormalities occurring in the uterus can be both congenital and acquired. The defects of Mullerian duct development constitute congenital anomalies and comprise septate, bicornuate, unicornuate and didelphys uterus. Some of the acquired abnormalities of the uterus are submucosal fibroids, endometrial polyps, intrauterine adhesions (Asherman syndrome) and cavity distortion by infection or surgical trauma.

One of the major causes of infertility among women is the tubal pathology, especially in areas where the pelvic inflammatory diseases and genital infections are common. The tubal anomalies comprise tubal occlusion (unilateral and bilateral), hydrosalpinx, and peri tubal adhesions, salpingitis isthmi nodosa. Pakistan, Nigeria, Bangladesh, and Nepal studies indicate tubal pathology in 30-55% of the infertile women and more in secondary infertility. The investigation of a female infertility patient includes an analysis of the ovarian functioning, tubal patency and uterine cavity anatomy. One approach to uterine and ovarian anatomy is ultrasonography, the ability of which is primitive to study the patency of tubes. This is due to the fact that the gold standard of determining tubal status is laparoscopy and chromopertubulation, which is an invasive procedure and costly, besides not being available in all locations.

The hysterosalpingography (HSG) has a special position as a least-invasive, low-cost, and very accessible examination due to the ability to evaluate the uterine cavity and tubal patency in a single study. This is the reason HSG has remained the most widely used first line study to undertake to work up infertility in the less developed economies such as Pakistan.



1.5 Primary and secondary infertility: concepts and relevance to imaging patterns

Infertile conditions are mainly classified as primary infertility-caused by a failure to conceive in a woman who has never been able to conceive pregnancy successfully- and secondary infertility-a failure to conceive after at least one previous pregnancy regardless of the outcome. These go beyond descriptive categories because the majority of the cases possess authoritatively diverse underlying risk patterns and pathways of the disease. The secondary infertility is highly frequent associated with the acquired pathology of the reproductive system that consists of the pelvic inflammatory disease, postpartum/ post-abortion infection and the tuberculosis of the genitals in the endemic areas all of which lead to the destruction of the tubes and the change of the uterine cavity. In most of the low- and middle-income countries, it is said that secondary infertility is higher than primary infertility. The publications in Pakistan have shown that the general infertility rate is about -22% with secondary infertility bearing a greater percentage than the primary infertility. Primary and secondary statistics of 4 percent and 18 percent respectively are the most prevalent. This kind of distribution has clinical diagnostic strategy implications that likelihood of the occurrence of tubal disease, intrauterine adhesions or sequelae, in the form of infection may be high in women with secondary infertility than in women with primary infertility.

1.6 The Principle and Procedure of Hysterosalpingography

A radiopaque contrast media can be injected transcervical into the uterus cavity during a radiopaque fluoroscopic examination called hysterosalpingography to investigate the uterine morphology and fallopian tubes patency. The operation is usually done at the early proliferative phase of the menstrual cycle, which is 7 to 12 days, so as to offer maximum vision of the uterine cavity and reduce the chances of interfering with an early pregnancy. The operation is done in an aseptic lithotomy position. A contrast agent that is water soluble and contains iodinated is injected into the cervical canal under fluoroscopic control through cannula or balloon catheter. The stages used to make serial pictures are the peritoneal spill stage, tubal opacification stage and uterine filling stage. women attribute infertility and the role played by the uterus and the fallopian tubes.



The problem of infertility is multi-progenic and multi-sub-genic. Part of the causes that aided in the formation of the overall infertility rate include male infertility, female infertility, combined infertility, and infertility that lacks explanations. Anatomical problems in the uterus and the fallopian tubes are among the various forms of female infertility ranked very high because the reasoning behind it is that they are the problems that are considered to be relatively common, and can be rectified, and the problems that are related to infertility even where ovulation has occurred.

Fluoroscopy is a common imaging technology that enables real time tracking of the internal body structures and activities depending on the continuous or pulsed X-ray beams. Unlike the conventional radiography, which yields still images, fluoroscopy gives a chance to observe the movement of organs and the appearance of the flow of a contrast medium due to which it may become an indispensable part of diagnostics and interventional practice in the framework of radiology.

Digital control of the images, flat-panel detectors, pulsed fluoroscopic systems, have over the years improved the quality of the images gained in the fluoroscopy that has minimized on the radiations applied in the procedure. These inventions have extended the use of the fluoroscopic procedures in certain fields of medicine such as gastroenterology, cardiology, urology, gynecology, and orthopedic specialty.

Fluoroscopy has wide application in the assessment of the functioning disorder of the gastrointestinal tract, urinary tract, vascular and cardiac system. The most common uses of fluoroscopy in diagnostics are in the barium study, hysterosalpingogram, voiding cystourethrogram, but the most common purpose of the interventional fluoroscopy in surgery is angiography, catheter placement, and minimal invasive surgery.

Despite these benefits of the use of fluoroscopy, the application of radiations is relatively high in its application than the conventional radionuclide process. It is therefore noteworthy that the rule of radiation safety and more so ALARA principle (As Low As Reasonably Achievable) must be upheld to the latter as such that would ensure that patient and operator exposures were as minimal as possible. Re-evaluation of the fluoroscopy practice is a modern trend due to the more emphasis on the use of technology and dose optimization.

Fluoroscopy has also been among the most significant types of imaging, which present highly valuable information regarding real time imaging. It is one of the significant studies in the direction toward improvement of the efficiency of imaging. Such reasons can be in broad terms divided into anatomic reasons.

Uterine -cavity abnormalities: congenital Mullerian abnormalities, endometrial polyps, submucosal fibroids, intrauterine adhesions (Asherman syndrome), abnormalities related to chronic endometritis, and abnormalities related to the adenomyosis (notwithstanding).

Tubal: proximal tubules occlusion, distal tubules occlusion, peri tubal adhesions (implied), hydro salpinx, salpingitis isthica nodosa. Cervical pathology: stenosis, mucus abnormalities (not so popular in the modern infertility examinations). Normal hysterosalpingogram will reveal normal uterus, smooth and trapezoidal form and leakage of peritoneum of the two fallopian tubes. Deviations of such pattern could be a sign of tubal or uterine illness.

The deformities in the uterus may be manifested through the gaps in fillings, asymmetry of the cavity edge or even abnormal cavity shape of HSG. The intrauterine adhesions lead to asymmetrical or angular defects, and submucosal fibroids tend to be relatively smooth structure rounded filling defects in nature. Congenital uterine abnormality may be typified by the normal forms of the cavities depending on the desiccation.

These are some of the cases of tubal abnormalities such as proximal or distal tubal obstruction, unilateral or bilateral obstruction, hydro salpinx which are tubes dilated and convoluted and loculated leakage of contrast which could be an indication of peri tubal adhesion.

In relation to reproductive physiology, a place of implantation is supposed to be provided by the uterus, oocyte retrieval and fertilization and the fallopian tubes is supposed to transport the embryo. The small issue in the tubes that could be caused by physical blockage, alteration of the

tubal mucosa and the inability of the tubal adhesions to allow the movement could change the probability of conception besides increasing the probability of ectopic pregnancy.

Why hysterosalpingography is important for infertility diagnosis?

One of the most appropriate first line imaging studies in the determination of infertility is the hysterosalpingography (HSG), which is not very expensive to have done and simultaneously the arrangement of the uterine cavity and that of the Tube patency is measured. In this case, hysterosalpingography has come to the list of standard first-line studies that are provided by the American Society of Reproductive Medicine (ASRM) in the diagnosis of tubal patency, should the tubal surgery be considered in this case.

The use of HSG is also being supported across the board due to the presence of the said test in the community and familiarity of the said test to the physician who administers it as well as its capacity to provide the information that may refer to the anatomy that may be the cause of further treatment such as laparoscopy or hysteroscopy or even assisted procreation though newer methods of the test have come into play like the hysterosalpingogram-contrast sonography. Abnormalities Pattern on HSG in Uterine Abnormalities.



Small studies in the field have also revealed that infertile women tend to have abnormalities in their uteruses during HSG. The Pakistani statistics showed that the most common consequences of infertile women are abnormalities of the uterus, submucosal fibroids, polyps, adhesions, and congenital imperfection.

Although the intrauterine growths and Asherman syndrome that is an undesirable complication of infection or surgical induced destruction of the uterus proliferate in secondary infertility, the congenital uterine disorders prevail in women with primary infertility.

The HSG is typically conducted during a premature proliferation stage of the menstrual cycle to avoid conducting the test during pregnancy, postmenstrual and preovulation to achieve the highest possible visualization. It is performed by instillation of antithesis with the help of the cervix and detecting the uterine cavity and entering the fallopian tubes to the peritoneal cavity. The results have been discussed against the following:

1. Uterine cavity outline and filling (which may indicate structural lesions or adhesions) deficiencies.
2. Vanessa, opacification, and tubes course.
3. Spillage of contrast of peritoneal cavity patency.
4. Aberrant dilatation, hydrosalpinx or loculated spill, which is evidence of adhesions.

HSG also has a few weaknesses. The spasm of tubes can be used to achieve the effect of proximal occlusion; technical difficulties can intervene on the effort to influence the visualization; the person can only see secondary evidence of the presence of peri tubal adhesion. In spite of these disadvantages, HSG could be clinically effective whether its usage is included in clinical history or not in addition to physical examination and other imaging processes. Apparent Uterine malformation: infertile patterns.

In order to state the abnormalities of the uterus as in the HSG work on infertility and infertility treatment, the abnormalities of the endometrial cavity, which could be observed, would be of the following forms:

They are the abnormal development, the fusion or the resorption of the Mullerian ducts. This can be added with the causes of infertility, pregnancy losses, preterm birth or positions. The cases of the inborn defects are also found at the expense of HSG, normal forms of cavity. These shapes include:

Septate Uterus: defect of filling in the mid line between the cavity; was more concerned with the miscarriage than infertility and was also considered in the study of infertility.

Bicornuate uterus: divergent horns; position arcuate; the diagnosis can be hard because of HSG, an external angle can be measured with 3D ultrasound or MRI scan. Unicornuate uterus One chamber; and might be primitive horned. Didelphys uterus: Two spaces/canals; heterogeneity of HSG, as far as far as cannulation is involved.

Salience of establishing the congenital abnormalities in a research procedure will entail the challenges associated with determining the congenital abnormalities in women with primary infertility versus secondary infertility and as such can be used to ascertain the treatment of hysteroscopic septum defects resection of a septate uterus. It is most probable that the emergence of the intrauterine adhesions would be predominated by the uterine instrumentation (dilation and curettage) and the post-partum bleeding, endometrial infections or traumas. These adhesions have been long since laid down as such as causing menstrual abnormalities, but at the same time can be administered with normal menstrual cycles as evidenced by infertility.

The most prevalent anomaly is the tubal pathology, which is observed in women of infertile women during HSG. It was found that the abnormalities of the tubes were present in over 50 per cent. of the research subjects with most of the tubes blocked bilaterally A disease prevalent among the women and would make them infertile.

High rate of chronic tubal disease is also portrayed by existence of hydrosalpinx, peri tubal adhesions and salpingitis isthmica nodosa among this group of people. These coincide with the local and the international studies which has cited that destruction of the tubes by infections is a significant cause of infertility in the women of the undeveloped nations. By so doing, it is likely that adhesions will be implementable especially in the segment of patients of secondary infertility, in an area like Pakistan where post-abortion and postpartum surgery is practiced in a highly divergent environment Endometrial polyps' sub mucosal and leiomyomas may result in distortion of the implantation process and may disrupt the implantation. HSG they are usually employed to evenly fill defects, HSG cannot be relied upon to make a distinction of polyps which is fibroids, hysteroscopy is normally required to be able to get to an ultimate diagnosis and treatment.

4) The switch of cavity in chronic infection GTB must be able to be applicable in a surrounding with an endemic of infection. The GBT impacts might have included the following effects; an abnormality of the uterine cavity, synechiae, shrinkage of the uterine cavity, and obstructed tubes. It is also found that Genital Tuberculosis is the cause of the clinical burden of

infertility-related assessment on the Pakistani literature. Even though the presence of asthma diagnosis can still be considered by HSG, there are typical appearances (T-shaped cavity, adhesions, rigid tubes, beading) that can make the suspicion and, therefore, create certain workup.

The results of the hysterosalpingography can be likened to obtain suitably effective information to cover the tendencies of the diseases and infertility. According to Pakistan and other reports, women are highly exposed to the risk of abnormal HSG outcome due to the fact that they are secondarily infertile.



The secondary infertile women are likely to be infertile because of the tubal blockage, hydrosalpinx, intrauterine adhesion and co-morbid pathologies of the tubal and uterine abnormalities. On the other hand, such women who are infertile in the primary manner stand high probabilities of having congenital abnormality uterus. The gap warrants the significance of classifying the infertile patients into their type when the explanations of the HSG findings are being made. Clinical and Public Health Significance.

This is due to the fact that the hysterosalpingography of the uterus and tubes is capable of detecting distortions in its timely intervention in the early stages of the reproductive process and the need to reduce the number of surgeries. Further therapy involving hysteroscopy, laparoscopy, medical therapy or HSG deferrals is determined by the outcome of the assisted reproductive therapy.

The readiness of tubal trauma connected with infection high and, hence, the requirement of the preventive measure in the form of increased obstetric care, infection management and patient education as a variable to the overall wellbeing of the patient. The concept of the local rates ought to be available since yield and relative rate of abnormal finding were not found to be equivalent

among groups. The data that is gathered in the developed world where the PID and tuberculosis are not as common and laparoscopy surgery is conducted at a younger age cannot be directly compared at the Pakistani location.

Certain Pakistani and local reports have been reported to have the results of HSG of infertile women and particularly comparing the differences between groups of infertile women with primary and secondary infertility. The research conducted in 2015 among 50 women in Pakistan has covered the primary and secondary infertile tubal obstruction as well as covering the bilateral and unilateral obstruction of tubes which revealed that tubal disease may be a common finding in the HSG. More recent literature has made comparisons between the HSG findings of a large size (hundreds of patients) and subfertility as indices of the clinical utility of the method and its ability to provoke prevalence levels. Tubular occlusion diagnosed with HSG: This implies the obstruction of the flow of the opaque material in a part of the fallopian Tube or the entire tube and does not leak to the peritoneal cavity and may be bilateral or unilateral.

The uterine contour could not be called normal, there were congenital defects, filling defects, abnormal margins or adhesions which should be presupposed by derangement or eradication of the cavity.

The trendiness or not trendiness of any abnormality of the uterus and the rate of commonality among Pakistani women with primary and secondary infertility have not been published appropriately because the hysterosalpingography is highly used in diagnosis of infertility. The gap in knowledge that will be addressed in the current study will be the justification of the evidence-based infertility treatment and prevention interventions with the help of the systematic evaluation of the hysterosalpingography of this cohort.

Chapter 2

Literature Review

Women in the world have a prevalent reproductive health issue of infertility. The abnormalities of both the fallopian tubes and uterus are among the severe causes of infertility in the female body. Hysterosalpingography (HSG) is a primary imaging procedure that is widely employed to establish the condition of the uterine cavity and tubal patency of infertile women.

Some of the studies observed several trends of uterine abnormalities and diverse rates of tubal obstruction on HSG in women with primary and secondary infertility. There is a growing problem of infertility in Pakistan but the outcome of HSG remains a little-known fact locally. The analysis of the previous study will help in understanding the general abnormalities pursued and a foundation on which the results of the research conducted on the Punjab population can be compared.

In one of the Nigerian tertiary hospitals, the authors in a cross-sectional study wanted to determine the outcome of hysterosalpingography (HSG) in infertile women and to relate it with the nature of infertility (Oyedepo et al., 2025). This was done on a sample of 125 women where the secondary infertility was more than the primary infertility. Bilateral tube obstruction and hydrosalpinx were the most frequent HSG findings together with uterine synechiae and tubal abnormalities. There was a high possibility of secondary infertility that was related to previous dilatation and curettage, miscarriage, and obstetric surgeries. The study has demonstrated that HSG can be used as a helpful diagnostic tool in cases that are resource-restrictive.

Khanal et al. (2023) study is a retrospective cross-sectional study that was conducted in a tertiary care center in Nepal to determine the outcomes of hysterosalpingography (HSG) usage in sub fertile women. They comprised of 196 women where primary subfertility was more common than secondary subfertility. Most of the subjects were normal in terms of the uterine cavity, the pathology was most often on the left-hand side, which was blocked in the tubes. The researchers indicated that approximately one in every five HSGs exhibited tubal pathology and it was necessary to state that HSG plays a significant role in the diagnosis of female infertility.

A prospective study involving the participation of a hospital was carried out by Rabbani Begum et al. (2025), and it compared the effectiveness of hysterosalpingography (HSG) in

detecting any factors of the tubes, as well as the presence of abnormalities in the uterus of the infertile women. The authors applied the sample of 50 ages between 20-40 years and primary infertility was more prevalent than secondary infertility. Most of the women were reported to have normal morphology of their uterus during HSG and a lesser percentage of the women to be having tubal abnormalities that included bilateral tubal block and hydrosalpinx. The findings favored the significance of HSG as a primary examination in the evaluation of infertility in low-resource settings.

The present study is a cross-sectional observational study that compared the results of hysterosalpingography in 150 infertile women in Bangladesh (Shermin et al., 2024). The secondary category had more infertility than the primary one with most of the women falling within the age bracket of 25-29 years. Tubal abnormalities were the most common and bilateral tubal blockage was the most frequent of the tubal abnormalities and were not as common as those of the uterine. The authors made the conclusion that HSG is a useful and cost-effective infertility test especially in cases where resources are limited.

One of the reproductive health issues that arise as a significant issue in the developing countries is infertility and hence hysterosalpingography (HSG) has been used as a first line diagnostic tool. A cross-sectional study by Oyedepo et al. (2025) on a Nigerian tertiary hospital, which comprised 125 infertile women, was a cross-sectional study, in which most of the women had been taken to the hospital with secondary infertility. Majority of them were observed to possess normal uterine cavities with most prevalent being uterine synechias and bilateral obstruction of the tubes. The present paper has highlighted the connection between secondary infertility and past obstetric and gynecological surgery and that HSG is still applicable in low-resource settings.

A study by Kayani et al. (2024) localized in Pakistan on the hysterosalpingography of the sub fertile women revealed an increased prevalence of the tubal pathology. Among 500 study participants primary subfertility was more common whereas the secondary subfertility had abnormal HSG results which were more common. The most frequent abnormalities were tubal blockage and hydrosalpinx, and the less frequent ones were the abnormalities of the uterus. The study restored the fact that HSG was a background, cost-effective, study on testing infertility. In the low-resource nations, hysterosalpingography (HSG) is a quite significant diagnosis and subfertility is an emerging concern in the field of reproductive health.

Aryal et al. (2025) implemented a cross-sectional study in Nepal, which involved 109 subfertile women in one of the hospitals. Primary subfertility was more prevalent than secondary subfertility and tubal abnormalities were highly associated with secondary subfertility. Findings in most of the cases were tubal blockage and hydrosalpinx when compared to the abnormality of the uterus which was prevalent in the cases of primary subfertility.

Bobmanuel et al. (2023) used hysterosalpingography and ultrasonography to measure the result of uterine and tubal assessment in infertile women in Nigeria, which was a cross-sectional descriptive study. The sample population consisted of 54 women with reproductive age, and secondary infertility was more prevalent than the primary one. The bilateral tubal occlusion was the most common reported histology of tubes in the form of HSG and the most common ultrasound reported abnormality of the uterus was uterine myoma. The findings highlighted a necessity to employ a combination of imaging modalities in order to diagnose infertility appropriately.

Chapter 3

Research Methodology

The current chapter outlines the research design, study location, population, sampling method, data gathering instruments, process, and statistical data analysis approach in an effort to establish the trends of uterine abnormalities and prevalence of tubal obstructing in hysterosalpingography (HSG) in women with primary and secondary infertility in Punjab, Pakistan.

3.1 Research Design

This research study employed cross-sectional research design based on the hospital. The objective of the study was to establish the prevalence of the abnormalities of the uterus, the nature and rate of the fallopian tube obstructions, and a comparison of the results of the women having primary and secondary infertility. Information was gathered at one time in the group of women who received an HSG to measure infertility. This is a research design that was deemed suitable to calculate the prevalence and determine the relationship between type of infertility and HSG results.

3.2 Study Setting

The current study was carried out at the Department of Radiology, Fatima Memorial Hospital, Lahore, Punjab, Pakistan, wherein the hysterosalpingography is regularly employed in the process of investigating the infertility issue in women.

3.3 Study Duration

The study period was two months, whereby the qualified respondents who were undergoing the procedure of HSG were recruited and their data were collected.

3.4 Study Population

Included in the study population were infertile women aged between 20-45 years and who consulted the hospital to have their infertility checked and the hysterosalpingography was done. Infertility was determined based on the world health organization (WHO) criteria and clinical categorization as defined in literature. Primary infertility is the failure to conceive one year of regular unprotected intercourse in a woman who had never conceived any pregnancy.

The secondary infertility is the inability to get pregnant after carrying a child to term, whether successful or not.

3.5 Sample Size

The sample size needed was determined with the help of Rao Soft sample size calculator and 218 women were chosen to take part in the study.

3.6 Sampling Technique

The method of sampling was a non-probability consecutive sampling. All the women who fulfilled the eligibility criteria and underwent HSG throughout the study period were then included consecutively until the sample size of 218 required was obtained.

3.7 Inclusion Criteria

To be a participant, the respondent had to meet the following criteria:

- Infertile women (primary and secondary).
- Age between 18-45 years.
- Referred for HSG
- Performed HSG on 7th -11th day of menstrual cycle.
- Menstruation under average age.
- Woman who has undergone surgeries in the past.

3.8 Exclusion Criteria

The participants were not taken into the study in case they had known.

- Women who are taking steroid use.
- Already implanted birth control.
- Refusal to participate

3.9 Study Variables

The independent variable in the study was the kind of infertility (primary or secondary infertility). The dependent variables were uterine abnormalities, the type of uterine abnormality, the presence/absence of tubal blockage, the type of tubal blockage (proximal or distal), the laterality of the blockage (unilateral and bilateral), and the peritoneal spillage. The covariates

that were taken in the research were age, length of infertility, having undergone previous surgery, and infection of the urinary tract.

3.10 Data Collection Tools

A structured research proforma was used to collect data which aimed at capturing demographic data, clinical history, and the HSG results. Hysterosalpingography was done with the help of the fluoroscopic imaging device, which will enable observing the contrast flow in the uterine cavity and fallopian tubes in real-time.

3.11 Data Collection Procedure

The study was given the ethical approval by the institutional review committee before data collection began. The radiology department was used to start the identification of eligible participants and to inform them about the purpose of the study. Each of the participants was enrolled with informed permission written consent. HSG was done at the early proliferative stage of menstrual cycle (day 5-12) in order to reduce the chances of becoming pregnant too soon. Through the process, an iodinated contrast medium that was soluble in water was injected into the uterine cavity. The successive fluoroscopic images were captured in order to assess the definition of the uterine cavity, the opacification of the fallopian tubes, and the presence or absence of peritoneal spill. Radiological reports that were generated by radiologists were examined and results were documented in the structured research proforma. Data that were collected were inputted into the Microsoft Excel and subsequently transferred to SPSS to be analyzed statistically.

3.12 Operational Definitions

A normal HSG was considered a smooth uterine cavity with free bilateral peritoneal spillage of contrast in the fallopian tubes.

The abnormalities of the uterus were both congenital (including septate, bicornuate, and unicornuate uterus) and acquired (including intrauterine adhesions, submucosal fibroid and polyps, and irregular margins of uterine cavity).

When the passage of the contrasts on one or both fallopian tubes was absent without peritoneal spillage, it was considered to be tubal blockage. Further classification of tubal obstruction was

done as either proximal or distal occlusion and unilateral or bilateral with respect to the number of tubes involved.

3.13 Statistical Analysis

The Statistical Package of Social Sciences (SPSS) was used to analyze all the data that was collected. Demographic characteristics and HSG findings were summarized using descriptive statistics, whereas the appropriate statistical tests were conducted to determine the relationship between the infertility type and radiological findings.

3.14 Ethical Considerations

The research was carried out following the set ethical standards. All participants were provided with informed consent that was done in written form before they were included in the study. The screening was voluntary in all aspects, and the respondents were made aware that they were free to pull out of the study at their own will without any penalties. The privacy and confidentiality of all the participants were kept in high order and no personal identifying information was provided. All the data collected had an academic and research purpose only.

Chapter 4

Results

Table 4. 1

Age		Frequency	Percent	Valid Percent	Cumulative Percent
Age	18-28	59	33.7	33.7	33.7
	29-39	106	60.6	60.6	94.3
	40-45	10	5.7	5.7	100.0
	Total	175	100.0	100.0	

Table 4.1 Frequency distribution of age

Table [4.1] presents the age distribution of the participants of the study (N = 175). The statistics indicate that the highest percentage of the study participants fell in this age group (29-39) comprising 60.6% (n = 106) of the total sample population. The next age group was 18-28 (33.7%= n = 59 of the participants). The most insignificant population group was 40-45 that had 5.7% (n = 10) of the sample in the population. On the whole, the cumulative percentage of the participants shows that a large proportion of the practices were among young to early-middle-aged adults (94.3%), thus, the study had a large proportion of this demographic.

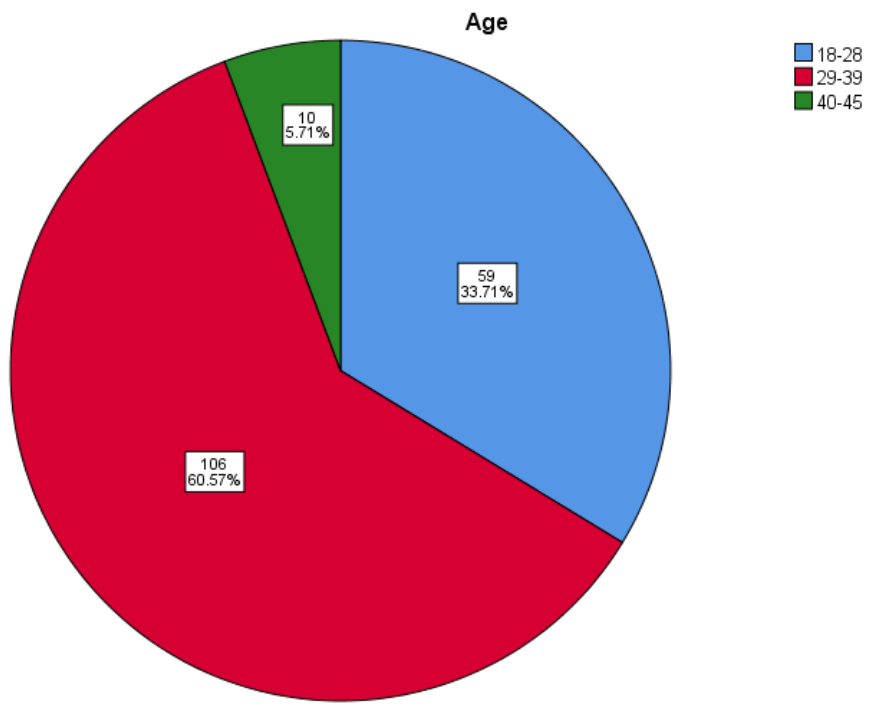


Figure 4. 1

Figure 4.1 pie chart of frequency distribution of age

The figure [4.1] breakdown of the respondents by age group. Most of the respondents are aged between 29 and 39 and there are 106 people in this group (60.57), which means that the large population of respondents is in their late twenties and thirties. The second largest section is the age group of 18 28 years which takes 59 people (33.71) indicating that younger adults are represented strongly in the sample. Conversely, the 40-45 age category presents the fewest numbers of 10 people (5.71) pointing out to the fact that not many respondents are of the older age bracket. In general, the sample is characterized by high representation of people aged 2939, moderate of 1828, and low of 4045.

Table 4. 2

Type of Infertility		Frequency	Percent	Valid Percent	Cumulative Percent
Type of infertility	Primary Infertility	90	51.4	51.4	51.4
	Secondary Infertility	85	48.6	48.6	100.0
	Total	175	100.0	100.0	

Table 4.2 frequency distribution of type of infertility

The table [4.2] illustrate distribution of the respondents based on the nature of infertility. The results indicate that Primary Infertility is a bit more common with the respondents, as it comprises of 90 people (51.4) out of the total sample. This means that over fifty percent of the respondents have never conceived a pregnancy even after the attempts to conceive.

Secondary Infertility on the other hand is in the form of 85 individuals (48.6) of the respondents. This implies that there is a significant number of respondents who had at least one pregnancy before but are now experiencing problems with conceiving.

All in all, the findings indicate that the prevalence of both types of infertility is nearly equal in the sample with Primary Infertility having a slightly bigger percentage than that of Secondary Infertility. This narrow distribution shows that both groups of respondents are almost equally affected by infertility in the respondents population under study.

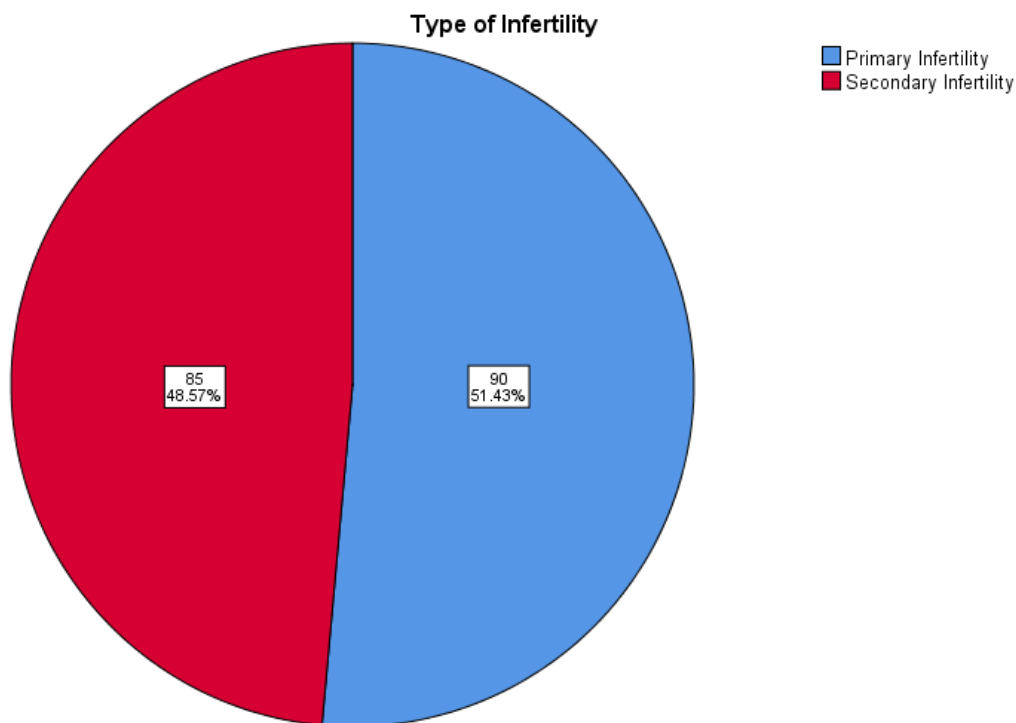


Figure 4. 2

Figure 4.2 pie chart of frequency distribution of type of infertility

The pie chart presents the distribution of the respondents according to the kind of infertility. The findings show that the Primary Infertility constitutes the slightly more significant part of the sample as it includes 90 respondents (51.43%). It implies that slightly over fifty percent of the respondents are yet to record a successful pregnancy after trying to conceive.

Secondary Infertility on the other hand claims 85 respondents (48.57%), which is almost half of the individuals used in the study. It means that a large share of the respondents has already conceived a child but now faces the problem of having another pregnancy.

Comprehensively, the chart indicates that either type of infertility is nearly equal between the respondents with Primary Infertility having slightly higher percentage than Secondary Infertility. The close distribution implies that infertility problems among the members of the study population impact members of both groups almost equally.

Table 4.3

Duration of Infertility		Frequency	Percent	Valid Percent	Cumulative Percent
Duration of infertility	< 1 Year	5	2.9	2.9	2.9
	1 - 5 years	127	72.6	72.6	75.4
	6 - 10 years	33	18.9	18.9	94.3
	11- 15 years	9	5.1	5.1	99.4
	≥ 16 years	1	.6	.6	100.0
	Total	175	100.0	100.0	

Table 4.3 frequency distribution of duration of infertility

Table [4.3] shows respondents based on the length of infertility among the participants of the study (n = 175). The findings reveal that most of the respondents have been infertile at 1 or 5 years and this aspect has a total of 127 respondents (72.6%). This indicates that majority of the participants of the research sought medical consultation in the initial years of infertility. A smaller fraction of the respondents indicated infertility between 6 to 10 years and this number was 33 participants (18.9). This presupposes that a significant population had been experiencing infertility over a greater period of time than or as the study was conducted. A small number of the participants were infertile over extremely long or extremely short periods. The lowest-number of early-duration cases (2.9% of the cases) consisted of 5 participants who had less than 1 year of infertility. In the meantime, 9 respondents (5.1%) had a period of infertility of 11-15 years, and only 1 respondent (0.65) had a period of infertility of 16 years and above. On the whole, the results indicate that the most significant proportion of the participants is infertile with the duration of 1-5 years and very long durations of infertility are rather uncommon in this sample. This distribution states that the majority of people are interested in evaluation or treatment during the initial few years of infertility.

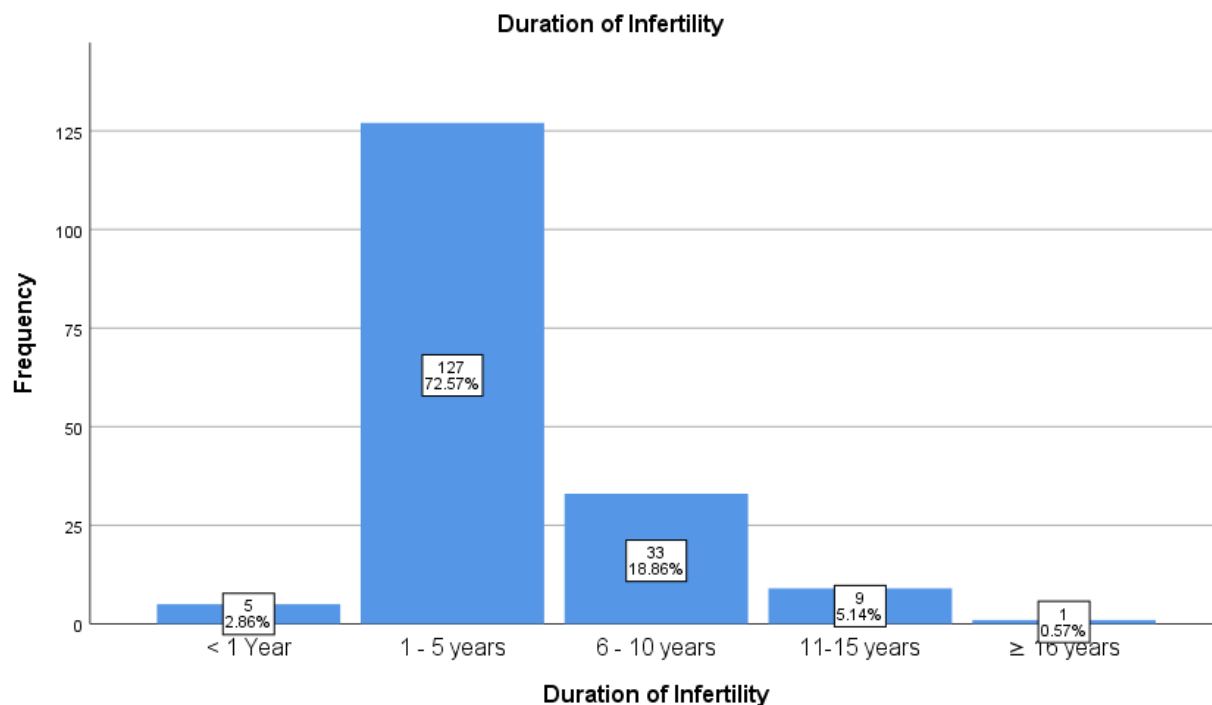


Figure 4. 3

Figure 4.3 bar chart of frequency distribution of duration of infertility

The figure illustrates the distribution of participants according to the duration of infertility among the study sample (n = 175). The majority of respondents experienced infertility for 1–5 years, with 127 participants (72.57%), indicating that most individuals in the study had been facing infertility for a relatively moderate duration before seeking or receiving medical attention.

The second largest group consisted of 33 participants (18.86%) who reported infertility lasting 6–10 years, showing that a considerable proportion of the participants had been experiencing infertility for a longer period. A smaller number of participants had infertility for 11–15 years, which included 9 participants (5.14%). Very few respondents reported either very short or very prolonged durations of infertility. Only 5 participants (2.86%) experienced infertility for less than 1 year, while 1 participant (0.57%) reported infertility lasting 16 years or more. Overall, the results indicate that infertility lasting 1–5 years is the most prevalent duration among the participants, whereas very short-term and extremely long-term infertility cases are relatively uncommon within this study population.

Table 4. 4

Menstrual Cycle		Frequ ency	Percen t	Valid Percent	Cumulative Percent
Menstr ual cycle	Regul ar	126	72.0	72.0	72.0
	Irregul ar	49	28.0	28.0	100.0
	Total	175	100.0	100.0	

Table 4.4 frequency distribution of menstrual cycle

Table [4.4] discusses the pattern distributions of menstrual cycles in the participants of the study (N = 175). Most of the respondents claimed to have a normal menstrual cycle with 126 people (72.0) out of the entire population. Conversely, 49 individuals (28.0%) stated that they had irregular menstrual cycle. This distribution means that the majority of the women represented by the study victims have a normal and consistent menstrual cycle, and a little over a quarter of the participants experienced irregularity in their menstrual cycles. The cumulative percentage also indicates that 72.0% of the sample are regular and that they have an additional percentage of 28 that is irregular which amounts to 100% of participants (N = 175). In general, the results indicate that menstrual regularity is comparatively common in the study sample as compared to menstrual irregularity.

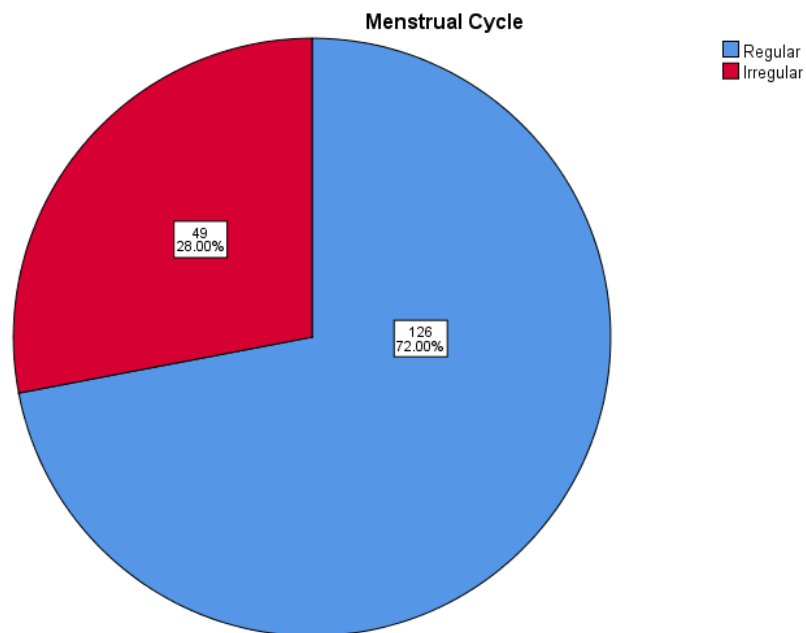


Figure 4. 4

Figure 4.4 pie chart of frequency distribution of menstrual cycle

The pie chart illustrates the pattern of distribution of menstrual cycle of the study participants (N = 175). Most of the respondents 126 people (72.0%), had a regular menstrual cycle, as indicated by the greater blue portion. On the other hand, 49 participants (28.0%) claimed to have irregular menstrual cycle, which was represented by the smaller red portion.

This means that the majority of the participants report regular menstrual cycles; a small proportion reports irregularity.

Table 4. 5

Average Cycle Length Days					
		Frequency	Percent	Valid Percent	Cumulative Percent
Menstrual Cycle length days	<18 days	10	5.7	5.7	5.7
	18 – 21 days	32	18.3	18.3	24.0
	22 – 25 days	85	48.6	48.6	72.6
	26 – 28 days	35	20.0	20.0	92.6
	>28 days	13	7.4	7.4	100.0
	Total	175	100.0	100.0	

Table 4.5 frequency distribution of average cycle length days

The table [4.5] presents the allocation of the sample to the study participants based on their average menstrual cycle length (n = 175). The findings indicate that close to 50% of the respondents counted a cycle length of 22-25 days with 85 (48.6) participants and was the one most reported cycle length in the study. The second most frequent one was 26-28 days, which was reported by 35 participants (20.0%), and then there was 18-21 days with 32 participants (18.3%). Such data reveal that a significant percentage of the participants had normal or near-normal menstrual periods. Less percentage of those who participated had shorter or longer cycle length, 10 participants (5.7%), had less than 18 days cycle length and 13 participants (7.4%), had more than 28 days cycle length.

All in all, the results indicate that most of the participants in the study had an average period of menstrual cycles of 22 to 28 days with very few participants having either very short or long periods of menstrual cycles.

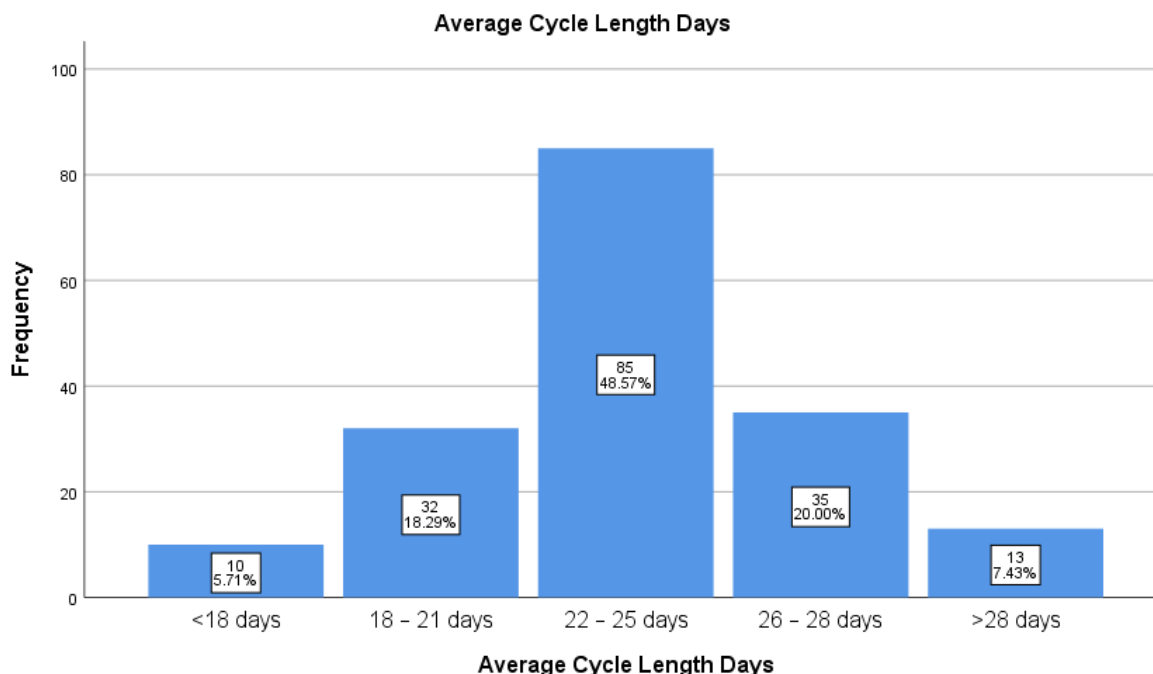


Figure 4. 5

Figure 4.5 bar chart of frequency distribution of average cycle length days

The figure shows selection of study sample based on average menstrual cycle length of the participants ($n = 175$). The highest percentage of respondents gave an average cycle length of 22-25 days as 85 (48.57%), which means that almost half of the respondents recorded a cycle length of 22 to 25. The second most prevalently occurring cycle length was 26-28 days and those had 35 participants (20.00%), then 18-21 days had 32 participants (18.29%). These results indicate that a significant percentage of the respondents had their menstrual cycles within the normal physiological limits. Fewer respondents reported having a shorter or longer cycle with 10 (5.71) having a cycle length of less than 18 days and 13 (7.43) having a length of more than 28 days.

In general, this number shows that most of the participants had an average menstrual cycle length of between 22 and 28 days, but very few participants had very short or very long menstrual cycle length.

Table 4. 6

Menarche Age		Frequency	Percent	Valid Percent	Cumulative Percent
Menarche age	7-9 years	30	17.1	17.1	17.1
	10-12 years	80	45.7	45.7	62.9
	13-16 years	65	37.1	37.1	100.0
	Total	175	100.0	100.0	

Table 4.6 frequency distribution of menarche age

The age of menarche of the participants (N = 175) indicates that the highest percentage of the sample 45.7% (n = 80) started their menarche at the age of 10-12 years. This is the modal age group in this study population. The second category was the highest number of 65 participants (37.1) who reached menarche at the age of 13-16 years. A lower percentage of the population, 17.1% (n = 30), had their first menarche during 7 to 9 years range. The cumulative data indicates that most of the participants (62.9) had attained menarche at the age of 12.

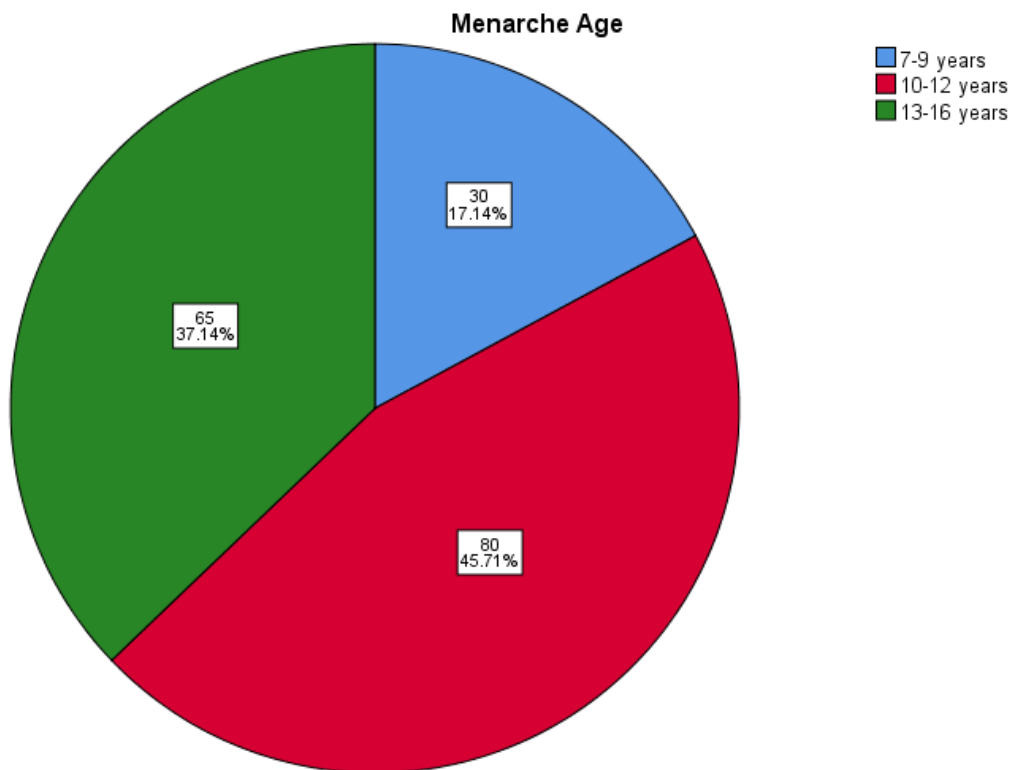


Figure 4. 6

Figure 4.6 pie chart of frequency distribution of menarche age

The pie chart shows that respondents were allocated by age at menarche. The results indicate that 45.71% (n = 80) of the participants had menarche at the age of 10-12 and 37.14% (n = 65) at the age of 13-16. A lesser percentage of, 17.14% (n = 30), started their menarche at the age of 7-9. These findings demonstrate that most of the participants reached menarche at an age ranging between 10-12.

Table 4. 7

History of Dysmenorrhea					
		Frequ ency	Percent	Valid Percent	Cumulative Percent
History of dysmenorr hea	Yes	55	31.4	31.4	31.4
	No	120	68.6	68.6	100.0
	Total	175	100.0	100.0	

Table 4.7 frequency distribution of history of dysmenorrhea

Table 4.7 represents how the participants were distributed with regards to their history of dysmenorrhea. The findings indicate that among 175 respondents, 31.4 percent (n = 55) stated that they had a history of dysmenorrhea and 68.6 percent (n = 120) stated that they had none. This shows that most of the subjects were without any previous history of dysmenorrhea.

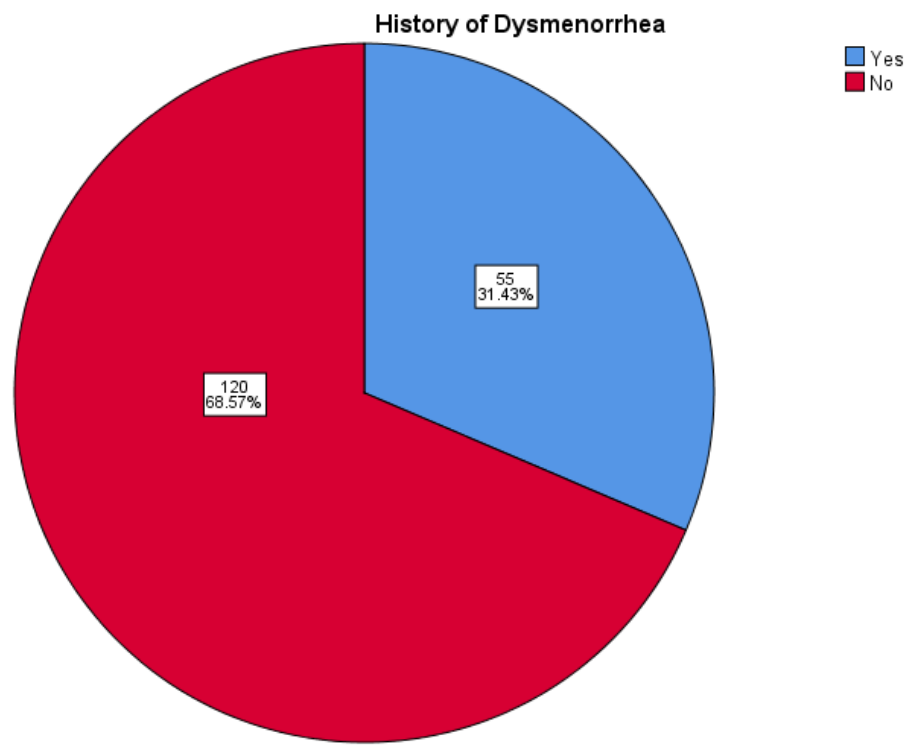


Figure 4. 7

Figure 4.7 pie chart of frequency distribution of history of dysmenorrhea

The figure depicts the distribution of the participants based on the history of dysmenorrhea. Among the 175 respondents, 55 respondents (31.43) indicated that they had a history of dysmenorrhea and 120 respondents (68.57) indicated that they had no history of dysmenorrhea. The results show that most of the respondents did not experience dysmenorrhea, with one-third of them complaining of having menstrual pain. This implies that a good number of the study population had dysmenorrhea.

Table 4. 8

Number of Abortions / Miscarriages					
		Freque ncy	Percen t	Valid Percent	Cumulative Percent
No. of Abortio ns	Zero	110	62.9	62.9	62.9
	1 Miscarria ges	45	25.7	25.7	88.6
	2 Miscarria ges	13	7.4	7.4	96.0
	3 Miscarria ges	4	2.3	2.3	98.3
	1 Abortion s	3	1.7	1.7	100.0
	Total	175	100.0	100.0	

Table 4.8 frequency distribution of number of abortions

The table [4.8] shows the statistics of number of abortions/miscarriages among the subjects of the study ($n = 175$). Most of the women 110 (62.9%), had no history of abortion or miscarriage. Out of the women who had a pregnancy loss, 45 (25.7) had one, 13 (7.4) had two and 4 (2.3) had three miscarriages. Furthermore, 3 (1.7) participants said that they have had one abortion.

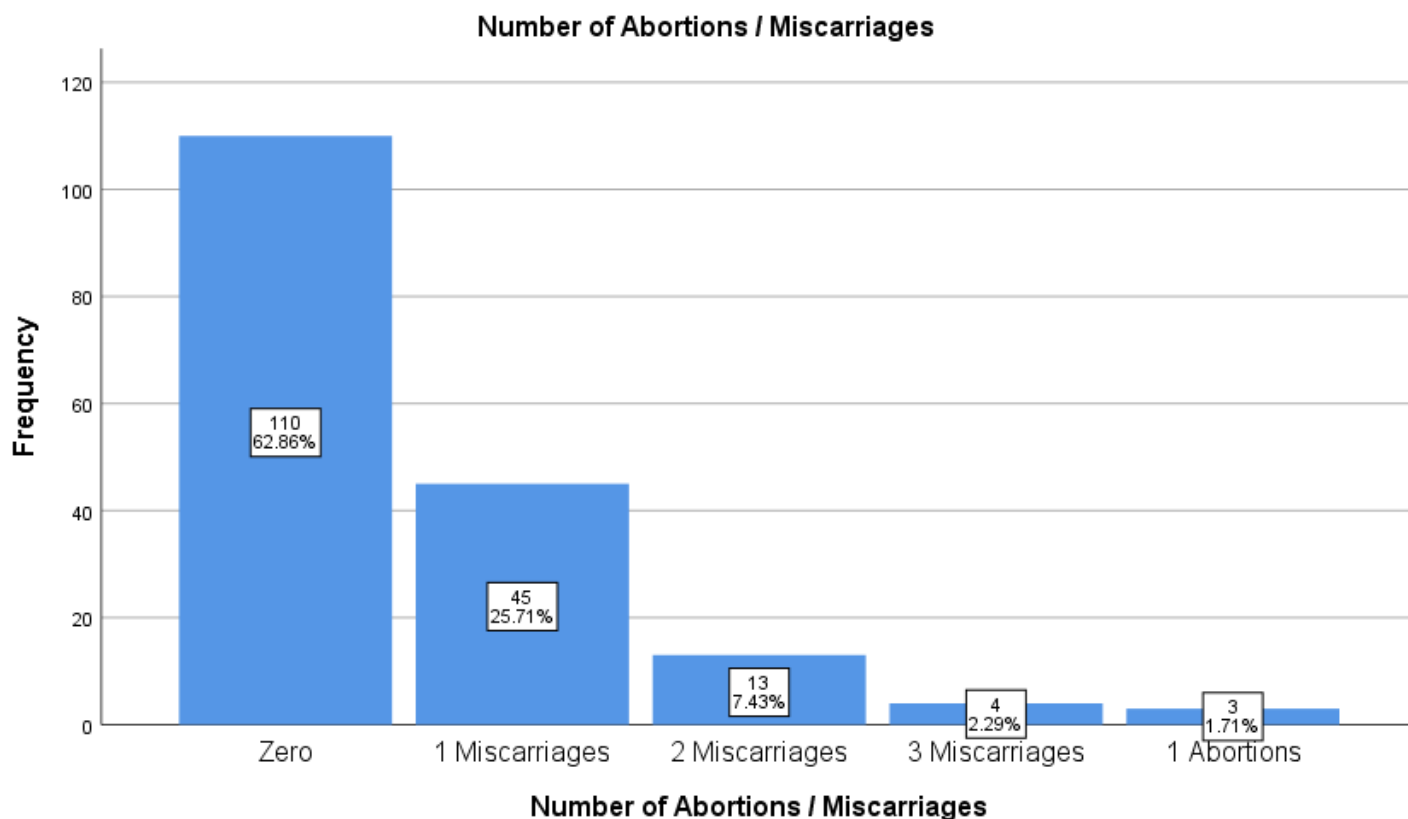


Figure 4. 8

Figure 4.8 bar chart of frequency distribution of number of abortions

The figure [4.8] describes the prevalence of Abortions and Miscarriages among the study population providing the information on the obstetric history of the participants. The statistics indicate that 62.86% of the cohort (n=110) has never had a pregnancy loss, which is referred to as Zero. This shows that among more than sixty percent of the sample, the present infertility issues are not complicated by the past miscarriages or abortions. Single miscarriage is the most common of the respondents who have had pregnancy loss, with 25.71% (45 cases) of the sample displaying it. Recurrent loss is much lower with 2 miscarriages reported by 7.43 (13 cases) and 3 miscarriages reported by 2.29 (4 cases) only. Also, 1 abortion had the lowest prevalence, which is only 1.71 percent (3 cases) of the sample. These results indicate that although most of the study population has never experienced pregnancy loss, more than a third of the participants are associated with an obstetric history characterized by at least one miscarriage and this could be a viable variable in clinical evaluation of their secondary infertility.

Table 4.9

History of Ectopic Pregnancy					
		Frequency	Percent	Valid Percent	Cumulative Percent
History of ectopic pregnancy	Yes	37	21.1	21.1	21.1
	No	138	78.9	78.9	100.0
	Total	175	100.0	100.0	

Table 4.9 frequency distribution of history of ectopic pregnancy

Table [4.9] displays their history of ectopic pregnancy. These indicate that 21.1% (n = 37) of the total population of 175 respondents had a history of having an ectopic pregnancy, and 78.9% (n = 138) did not have a history of having an ectopic pregnancy. This means that the majority of the respondents had not undergone ectopic pregnancy.

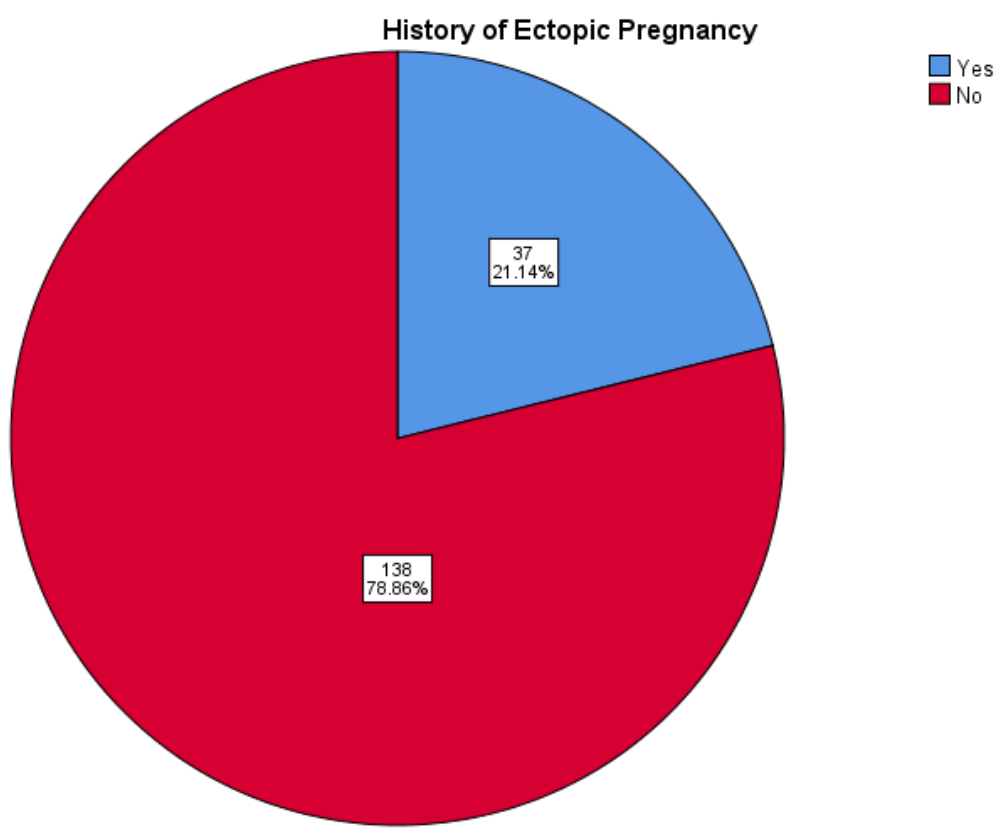


Figure 4. 9

Figure 4.9 pie chart of frequency distribution of history of ectopic pregnancy

In the pie chart, the participants have been distributed based on the history of ectopic pregnancy. Among the 175 respondents, there were 37 respondents (21.14) who said they had ectopic pregnancy history and 138 respondents (78.86) said they had no ectopic pregnancy experience. The findings show that most of the interviewees had not undergone ectopic pregnancy, but fewer percentage participated in the condition. This is indicative that ectopic pregnancy was not very prevalent within the population that was studied.

Table 4. 10

Previous Surgery					
		Frequency	Percent	Valid Percent	Cumulative Percent
Previous surgery	No previous surgery	141	80.6	80.6	80.6
	Diagnostic / Minor pelvic procedure (Laparoscopy, D&C)	17	9.7	9.7	90.3
	Tubal surgery (salpingectomy, tubal repair, ligation, ectopic surgery)	9	5.1	5.1	95.4
	Uterine surgery (myomectomy)	6	3.4	3.4	98.9
	Appendectomy	1	.6	.6	99.4
	Inguinal Cystectomy	1	.6	.6	100.0
	Total	175	100.0	100.0	

Table 4.10 frequency distribution of previous surgeries

Table [4.10] presents the past surgeries in the study population (N =175). Most of the participants were 141 patients (80.6%), who had never undergone a surgery. Surgical history On patients with a surgical history, most common were diagnostic or minor pelvic procedures laparoscopy or D&C (17 patients 9.7%). In 9 patients (5.1%), tubal surgeries (salpingectomy, tubal repair, ligation or ectopic surgery) were reported with the uterine surgery (myomectomy) reported in 6 patients (3.4%). Appendectomy and inguinal cystectomy were also uncommon and were found in 1 patient (0.6%). All in all, these results show that the majority of patients had no previous surgery operations, and those who underwent surgery before, the most common surgeries included minor pelvic or tubal surgeries.

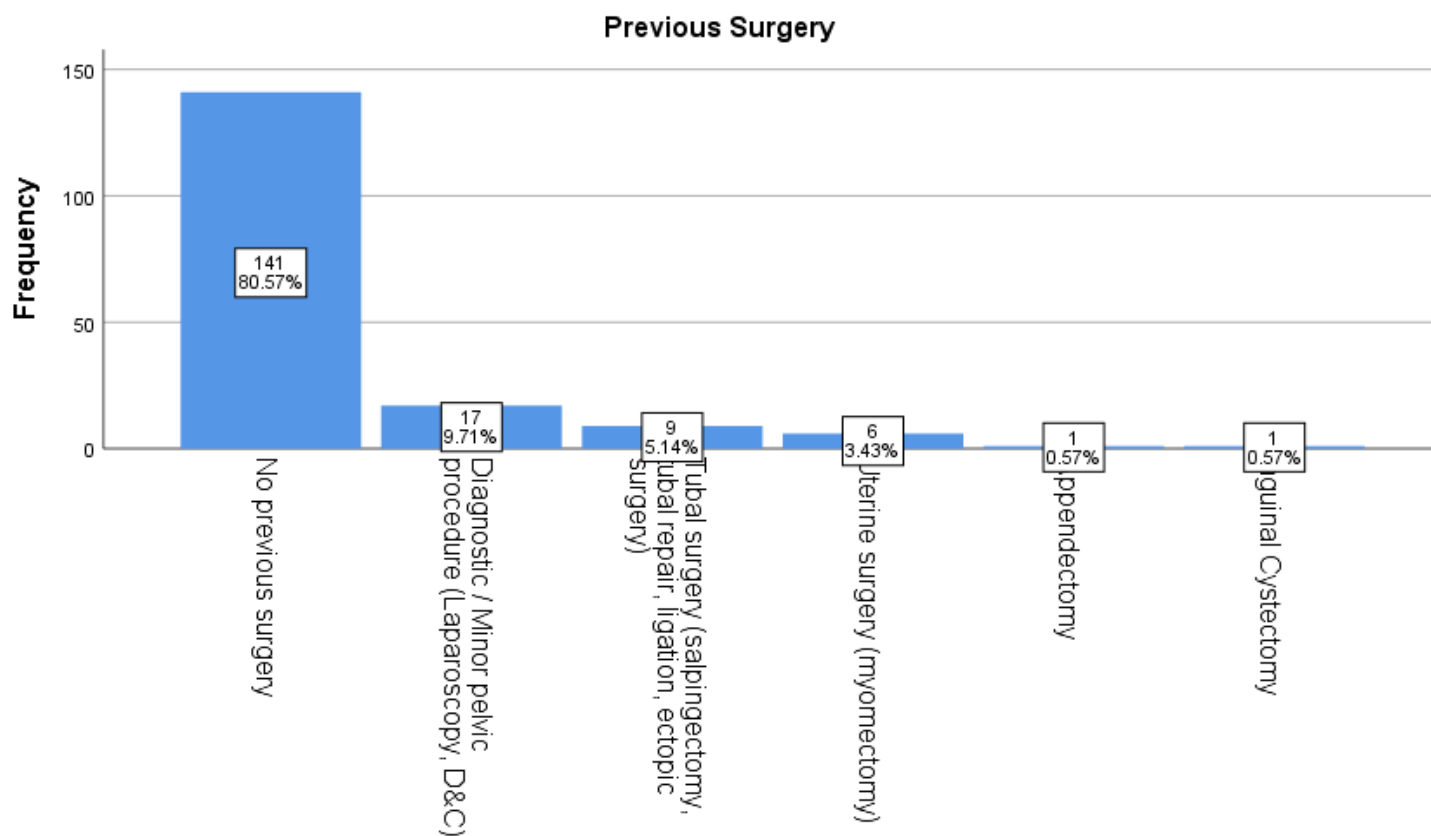


Figure 4. 10

Figure 4.10 bar chart of frequency distribution of previous surgeries

Figure [4.10] shows the Prior Surgery among the study population. The statistics show that a vast majority of the respondents, 80.57% of them, who had no history of any prior surgery (n=141), provide a baseline of surgical naivety among the majority of the cohort. Other minority who reported having undergone previous surgical intervention were Diagnostic or Minor pelvic procedures (including Laparoscopy and D&C) which were the most prevalent 9.71% (17 cases). There was a marked decrease in the major gynecological and abdominal surgeries. Tubal surgery with salpingectomy, tubal repair, tubal ligation or ectopic surgery was documenting 5.14% (9 cases) and then Uterine surgery (myomectomy) with 3.43% (6 cases). There were a small number of non-gynecological operations, with the lowest rates of 0.57 and 0.57 respectively of the total population, being the Appendectomy and Vaginal Cystectomy. These results indicate that even though the majority of patients in this infertility research have no history of surgery, the most appropriate previous treatment in the symptomatic group is minor diagnostic operations and tubal-related surgeries.

Table 4. 11

Urinary Tract Infections					
		Frequency	Percent	Valid Percent	Cumulative Percent
Urinary tract infections	Yes	24	13.7	13.7	13.7
	No	151	86.3	86.3	100.0
	Total	175	100.0	100.0	

Table 4.11 frequency distribution of urinary tract infections

Table [4.11] shows the distribution of the participants based on the presence of urinary tract infections. The findings reveal that 13.7 percent (n=24) of the respondents had experienced urinary tract infection and 86.3 percent (n=151) had not experienced any type of infection. These results show that the majority of the participants did not complain of urinary tract infections.

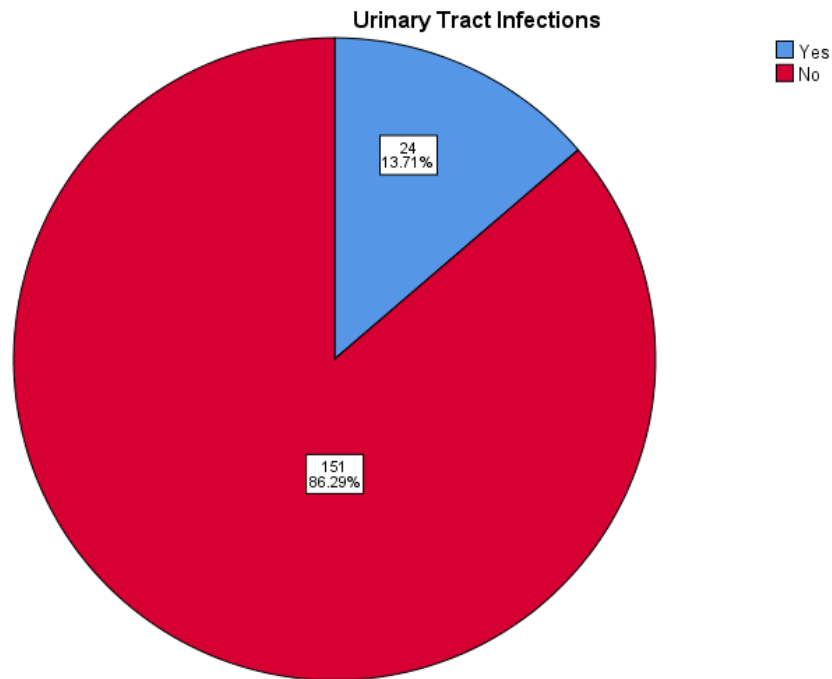


Figure 4. 11

Figure 4.11 pie chart of frequency distribution of urinary tract infections

The pie chart demonstrates the scheme of the urinary tract infections (UTI) among the participants of the study. The data of 175 women showed that 24 (13.71) had a history of urinary tract infection, and most of them 151 (86.29) had no history of urinary tract infection. This means that the majority of the study population consisted of participants who were not influenced by UTI as the percentage of those who had suffered UTIs was very low.

Table 4. 12

Uterine Cavity Appearance					
		Frequency	Percent	Valid Percent	Cumulative Percent
Uterine cavity appearance	Normal	118	67.4	67.4	67.4
	Irregular Cavity	57	32.6	32.6	100.0
	Total	175	100.0	100.0	

Table 4.12 frequency distribution of uterine cavity appearance

Table [4.12] shows the comparison of uterine cavity appearance in 175 women (n = 175). Most of the subjects possessed normal uterine cavity as was seen in 118 subjects (67.4%), meaning that over two out of three of the study subjects had normal uterine cavity results. The abnormal uterine cavity was detected in 57 participants (32.6%), which is about a third of the number of participants and the indication of abnormalities in the uterine cavity. Comprehensively, the results show that the vast majority of the subjects had a normal uterine cavity (n = 118, 67.4%), but a significant percentage of the participants had an abnormal uterine cavity (n = 57, 32.6%).

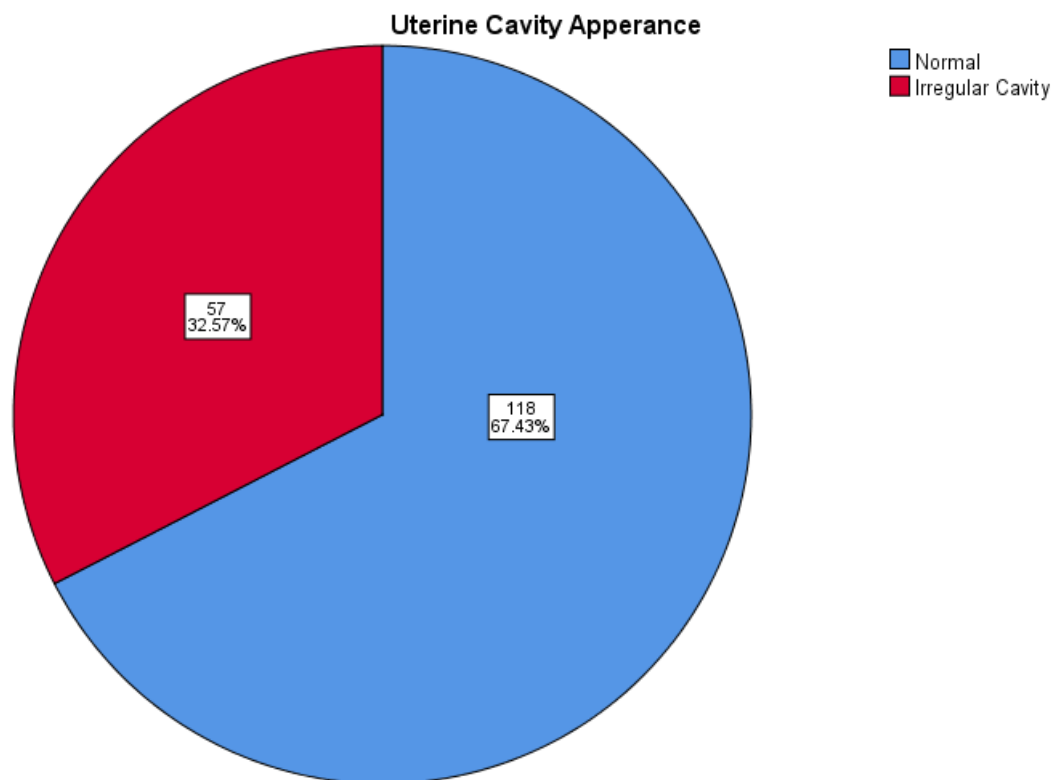


Figure 4. 12

Figure 4.12 pie chart of frequency distribution of uterine cavity appearance

The pie chart demonstrates the allocation of the uterine cavity appearance among the population of the study (N = 175). Among the overall 175 patients, 118 patients (67.43) had a normal uterine cavity which constituted the greater population of the sample. On the contrary, 57 patients (32.57) were observed as having irregular uterine cavity. It suggests that two-thirds of the patients were carrying a normal uterine cavity and only one-third of the patients exhibited irregular cavity. Despite the fact that the more typical cases were normal uterine cavities among the study population, the percentage of irregular cavities is still high, which shows the existence of the abnormalities in uterine cavity in a considerable number of the patients.

Table 4. 13

Uterine Congenital Anomaly					
		Frequency	Percent	Valid Percent	Cumulative Percent
Uterine congenital anomaly	Unicornuate	6	3.4	3.4	3.4
	Bicornuate	5	2.9	2.9	6.3
	Septate uterus	1	.6	.6	6.9
	Arcuate uterus	34	19.4	19.4	26.3
	Normal	129	73.7	73.7	100.0
	Total	175	100.0	100.0	

Table 4.13 frequency distribution of uterine congenital anomalies

The table [4.13] shows the frequency of uterine congenital abnormalities in the study population (N = 175). The results suggest that most of the subjects, 129 (73.7), did not have any congenital abnormality of the uterus. Nevertheless, 46 patients (26.3) were detected to have various forms of congenital uterine anomalies. Arcuate uterus was the most common of the anomalies, and was reported in 34 patients (19.4%). This was succeeded by unicornuate uterus in 6 patients (3.4%), bicornuate uterus in 5 patients (2.9%). The least utilized anomaly was septate uterus, which was detected in 1 patient (0.6%). On the whole, the results indicate that despite the fact that the major part of the patients had regular uterine anatomy, a significant number of patients had congenital uterine defects, and the most common form of uterine defect in the target group was arcuate uterus.

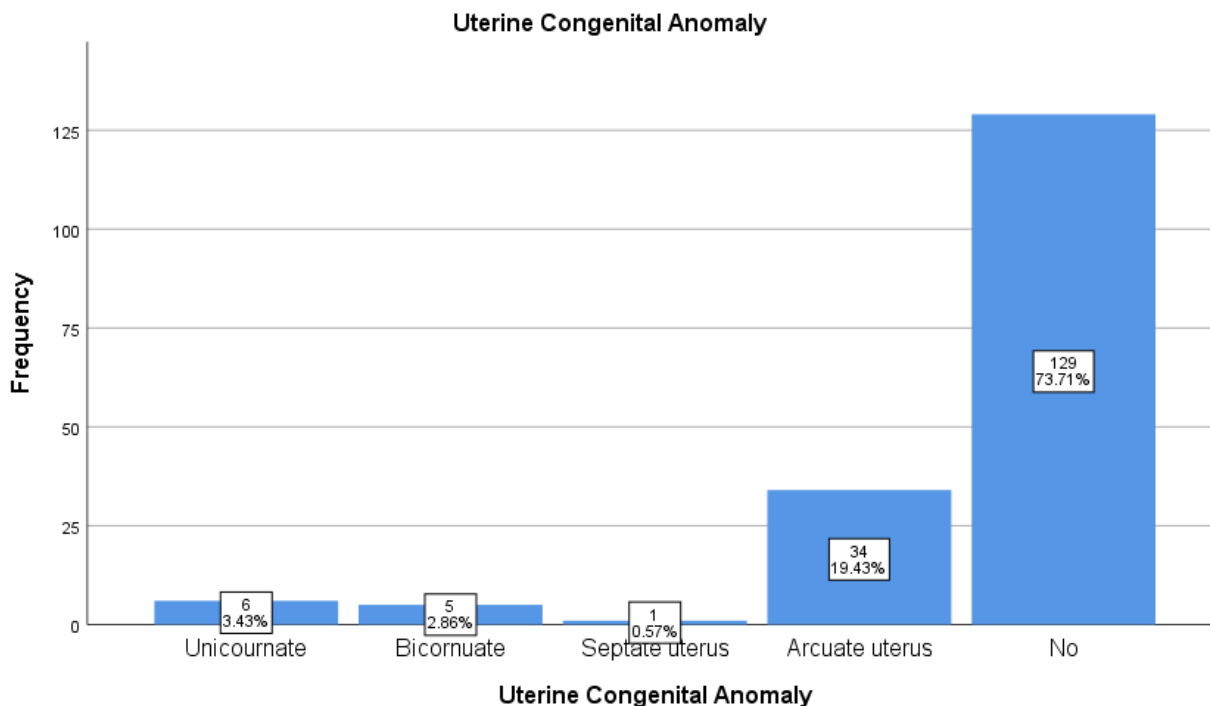


Figure 4. 13

Figure 4.13 bar chart of frequency distribution of uterine congenital anomalies

The figure above shows how the uterine congenital anomalies were distributed among the study participants (n = 175). The largest proportion of patients 129 (73.71) were without congenital anomaly of the uterine, which means that most of the participants had a normal uterine cavity. The most common anomaly that was detected was arcuate uterus, which was found in 34 patients (19.43%). Less common maladies were the presence of unicornuate uterus in 6 patients (3.43%) and bicornuate uterus in 5 patients (2.86%). The rarest anomaly was that of septate uterus which was found in 1 patient (0.57%).

All in all, the results indicate that, although some of the participants had congenital uterine anomalies, most of the study sample did not have any structural abnormality of the uterus, with the arcuate uterus being the most common among the affected.

Table 4. 14

Right Fallopian Tube					
		Frequency	Percent	Valid Percent	Cumulative Percent
Right fallopian tube	Patent	104	59.4	59.4	59.4
	Proximal Block	43	24.6	24.6	84.0
	Distal Block	28	16.0	16.0	100.0
	Total	175	100.0	100.0	

Table 4.14 frequency distribution of right fallopian tube

Table [4.14] presents the findings associated with the right fallopian tube in 175 respondents (n = 175). Most participants had patent right fallopian tube (as seen in 104 participants (59.4%)) which showed that the tubal patency on the right was normal in over half of the participants in the study. The proximity of the block to the right fallopian tube was observed in 43 participants (24.6%), which indicated that about a quarter of the participants had their proximal block being between the uterine and the terminal end of the tube. Also, there was a report of a distal block (16.0 per cent) in 28 participants, which represented blockage at the end of the tube (distal or fimbrial) in a lower percentage of the study population.

In general, the results indicate an occurrence of most subjects had a patent right fallopian tube (n = 104, 59.4), proximal block (n = 43, 24.6), and distal block (n = 28, 16.0) among a significant number of subjects.

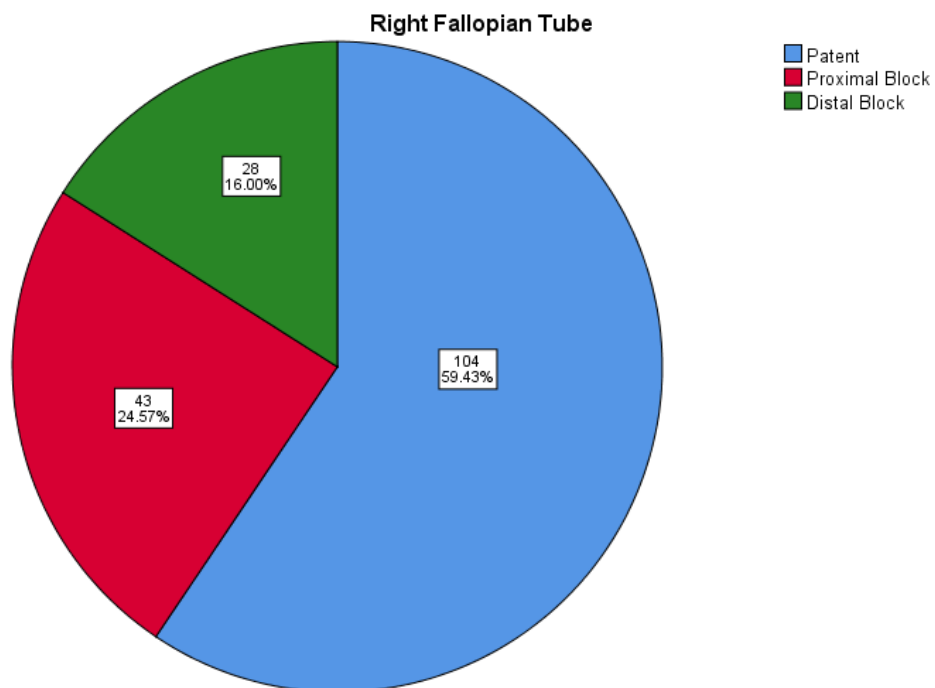


figure 4. 14

Figure 4.14 pie chart of frequency distribution of right fallopian tube

The pie chart illustrate the presentation of results of the right fallopian tube in 175 subjects (n = 175). Patent right fallopian tube had the highest percentage of participants with 104 participants (59.43%), which showed that over half of the study population had a normal fallopian tube on the right side. In 43 subjects, a proximal block was detected (24.57%), which is a quarter of the respondents and demonstrates an obstruction close to the uterine end of the tube. As well, 28 participants were reported to have a distal block (16.00%), which is the blockage at the distal or fimbria end of the tube in the smaller percentage of subjects. On the whole, the chart demonstrates that the most frequent finding was the confirmation of the patency of the right fallopian tube (n = 104, 59.43), distal block (n = 28, 16.00), and proximal block (n = 43, 24.57) among the study participants.

Table 4. 15

Left Fallopian Tube					
		Freque ncy	Percen t	Valid Percent	Cumulative Percent
Left fallopian tube	Patent	114	65.1	65.1	65.1
	Proximal Block	28	16.0	16.0	81.1
	Distal Block	33	18.9	18.9	100.0
	Total	175	100.0	100.0	

Table 4.15 frequency distribution of left fallopian tube

Table 4.15 shows the findings concerned with the left fallopian tube in 175 interviewees (n = 175). Most of the respondents had a patent left fallopian tube, which was noted in 114 respondents (65.1%), meaning that most of the respondents in the study had normal tubal patency on the left-hand side.

In 28 respondents (16.0 percent), a proximal block of the left fallopian tube was detected implying that there was some obstruction towards the uterine end of the tube in a smaller proportion of the respondents.

Also, 33 subjects were found to have distal blockage (18.9%), which was an indication of blockage of the tube towards the end, distal, or fimbria in almost one-fifth of the sample. In general, the findings suggest that most of the participants had left fallopian tube patent (n = 114, 65.1%), but a significant amount had proximal block (n = 28, 16.0%), and distal block (n = 33, 18.9%).

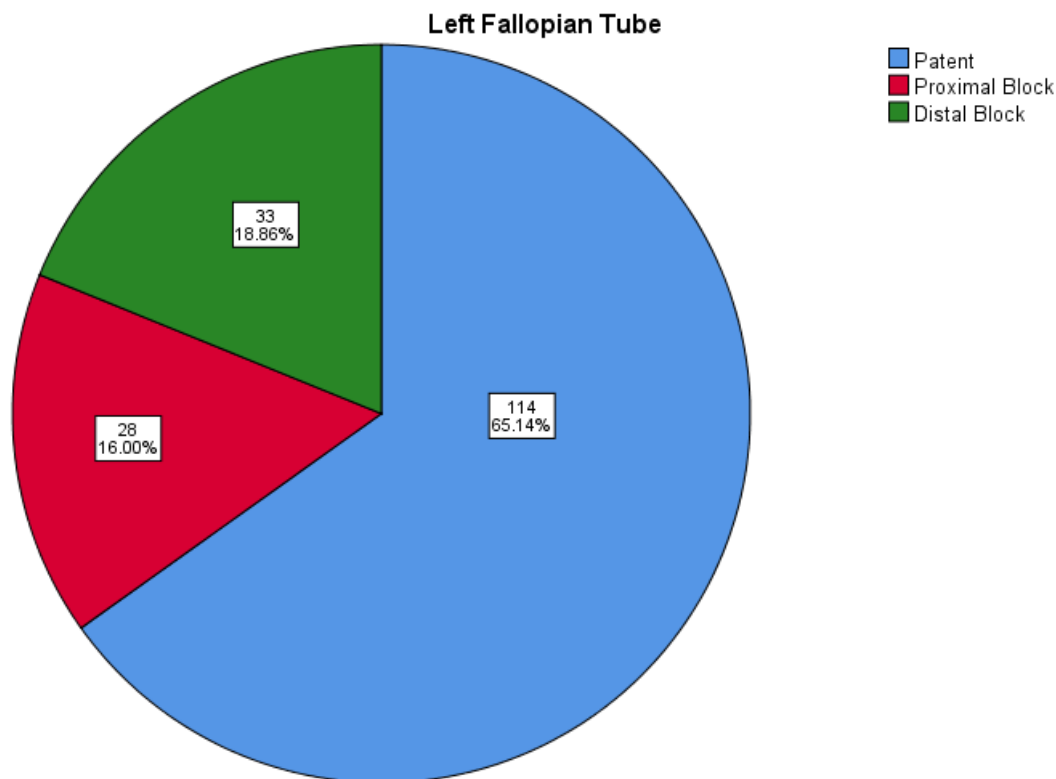


Figure 4. 15

Figure 4.15 pie chart of frequency distribution of left fallopian tube

The pie chart is used to show the distribution of the findings associated with the left fallopian tube of 175 participants ($n = 175$). The highest percentage of the participants were one with a patent left fallopian tube which was noted in 114 (65.14) study participants and it was thus seen that most of the study population had a normal tubal patency on the left side. The result showed that almost one-fifth (33) of the participants had a distal block of the left fallopian tube (18.86%). In the meantime, one proximal block was noted among 28 participants (16.00%), which means that they were blocked near the uterine end of the tube in less percentage of the study population. In general, the chart shows that the most frequent result was the patency of the left fallopian tube ($n = 114$, 65.14), whereas the percentage of distal block ($n = 33$, 18.86) and proximal block ($n = 28$, 16.00) remained lower among the participants.

Table 4. 16

Peritoneal Spill		Frequency	Percent	Valid Percent	Cumulative Percent
Peritoneal spill	Bilateral Free Spill	80	45.7	45.7	45.7
	Unilateral Spill	55	31.4	31.4	77.1
	No Spill	40	22.9	22.9	100.0
	Total	175	100.0	100.0	

Table 4.16 frequency distribution of peritoneal spill

A total of 175 participants were evaluated for the presence of peritoneal spill. The results showed that bilateral free spill was the most common finding, observed in 80 participants (45.7%). This indicates that nearly half of the study population had patent fallopian tubes on both sides. Unilateral spill was identified in 55 participants (31.4%), suggesting that approximately one-third of the participants had tubal patency on only one side, which may indicate a unilateral tubal blockage. In contrast, no spill was reported in 40 participants (22.9%), reflecting bilateral tubal blockage in nearly one-quarter of the participants. Overall, the findings demonstrate that while the majority of participants exhibited some degree of tubal patency (77.1%), a considerable proportion (22.9%) had complete tubal obstruction, which may contribute to infertility in the studied population.

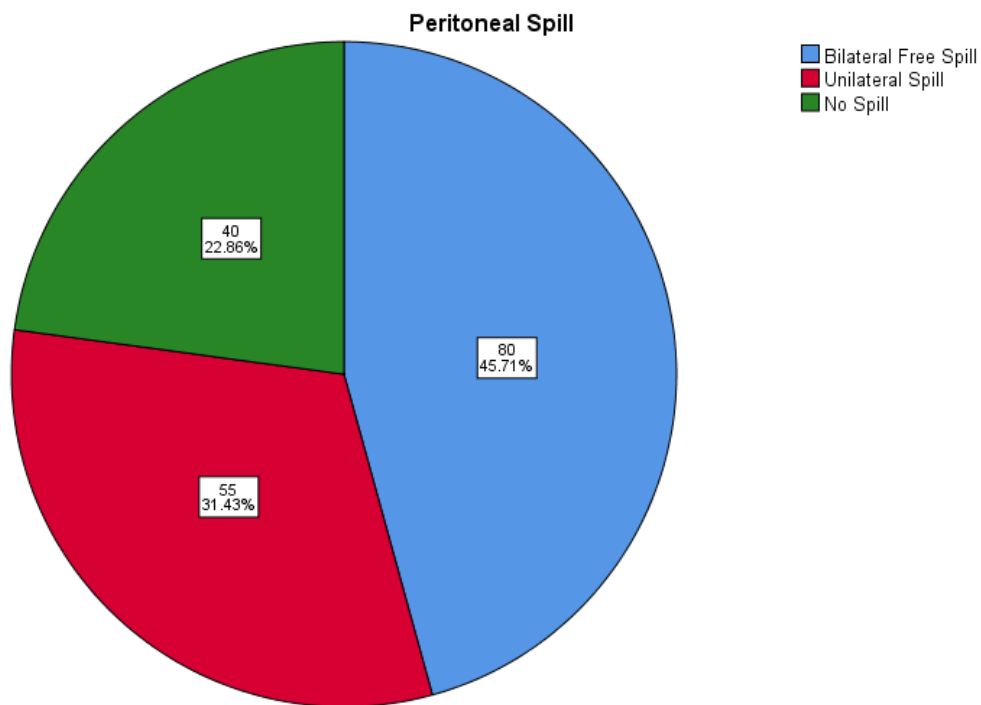


Figure 4. 16

Figure 4.16 pie chart of frequency distribution of peritoneal spill

The pie chart presents the results of peritoneal spill distribution across 175 respondents. The highest percentage of the respondents responded to bilateral free spill, which constituted 80 cases (45.71) meaning that almost half of the sample size in the study was bilaterally patent in the fallopian tubes.

A unilateral spill was witnessed in 55 participants (31.43%), and this constituted approximately a third of the cases, indicating that the fallopian pipes of one side are clear, and the opposite side is blocked.

Conversely, there was no spill among 40 participants (22.86%), and this implies that bilateral tubal blockage occurred in almost a quarter of the subjects. On the whole, it can be seen that bilateral free spill is the predominant, it is followed by unilateral spill, and no spill is the least frequent outcome of the study participants.

Table 4. 17

Overall HSG Impression					
		Frequency	Percent	Valid Percent	Cumulative Percent
Overall HSG impression	Normal Study	45	25.7	25.7	25.7
	Uterine Abnormality	36	20.6	20.6	46.3
	Tubal Pathology	57	32.6	32.6	78.9
	Combine Uterine and Tubal Pathology	37	21.1	21.1	100.0
	Total	175	100.0	100.0	

Table 4.17 frequency distribution of overall HSG impression

The general HSG results of the study population (N = 175) indicate that 45 patients (25.7% of the total number) had a normal HSG study. The other 130 patients (74.3%) had other forms of abnormalities. The most common abnormal finding was the presence of tubal pathology which was identified in 57 of the patients (32.6%). This was then succeeded by combined uterine and tubal pathology in 37 patients (21.1%), isolated uterine abnormalities were detected in 36 patients (20.6%). These results show that the abnormal HSG results were more common as compared to normal results in the research population, and tubal pathology was the most common abnormality.

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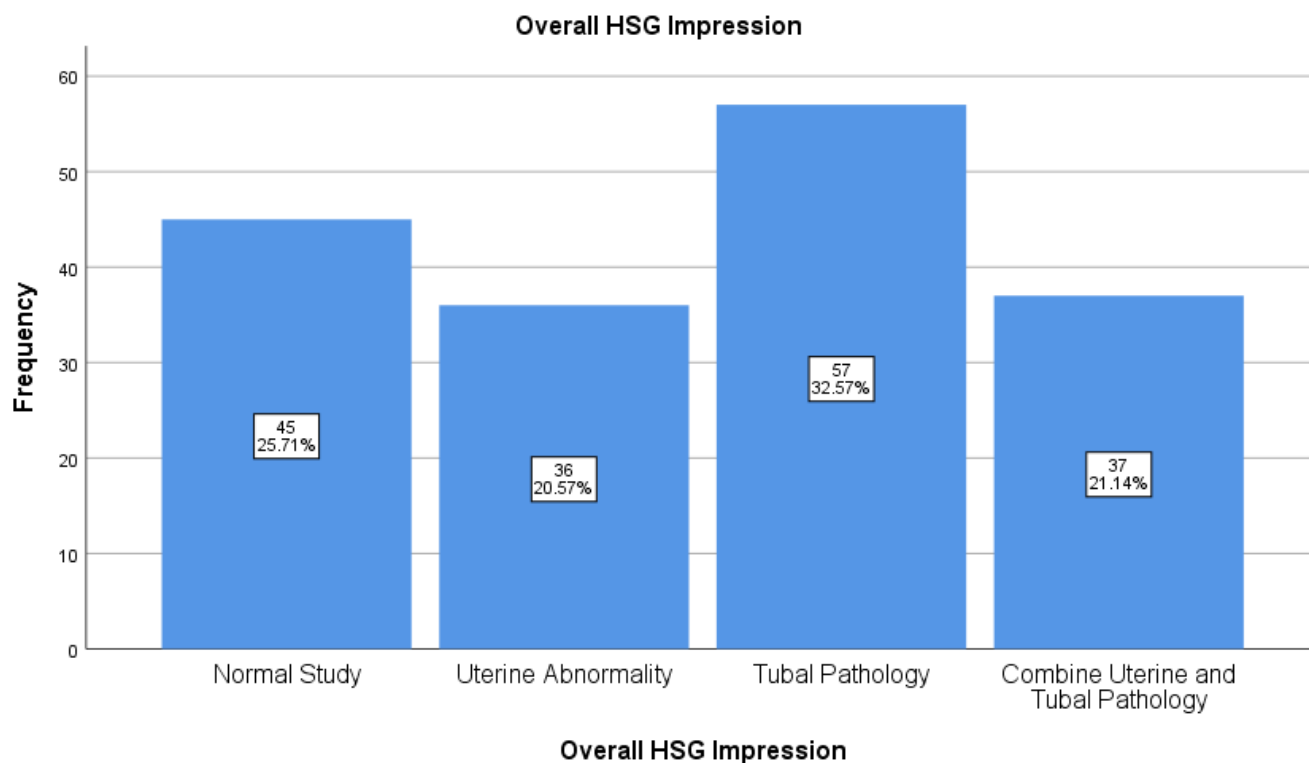


Figure 4. 17

Figure 4.17 bar chart of frequency distribution of overall HSG impression

The overall HSG findings among the study population (N = 175) demonstrate that 45 patients (25.7%) had a normal HSG study. The remaining 130 patients (74.3%) showed different types of abnormalities. Among the abnormal findings, tubal pathology was the most common, observed in 57 patients (32.6%). This was followed by combined uterine and tubal pathology in 37 patients (21.1%), while isolated uterine abnormalities were identified in 36 patients (20.6%). These findings indicate that abnormal HSG results were more prevalent than normal findings in the study population, with tubal pathology representing the largest proportion of abnormalities.

Table 4. 18

Overall HSG Impression	Primary Infertility (n=90)	Secondary Infertility (n=85)	Total (n=175)
Normal Study	31 (68.9%)	14 (31.1%)	45 (25.7%)
Uterine Abnormality	19 (52.8%)	17 (47.2%)	36 (20.6%)
Tubal Pathology	25 (43.9%)	32 (56.1%)	57 (32.6%)
Combined Uterine and Tubal Pathology	15 (40.5%)	22 (59.5%)	37 (21.1%)
Total	90 (51.4%)	85 (48.6%)	175 (100%)

Table 4.18: Overall HSG Impression by Type of Infertility (Crosstabulation)

The Table [4.18] shows the HSG Impression in a sample of 175 people, and comparing between Primary and Secondary Infertility (sample sizes of 90 and 85, respectively). The data shows that, Tubal Pathology is the most common finding of overall diagnosis as it is found in a total population of 32.6 (57/175) individuals of the study. In this group, Secondary Infertility (56.1) overtakes Primary Infertility (43.9) and this supports the clinical importance of tubal factors in preconceived patients.

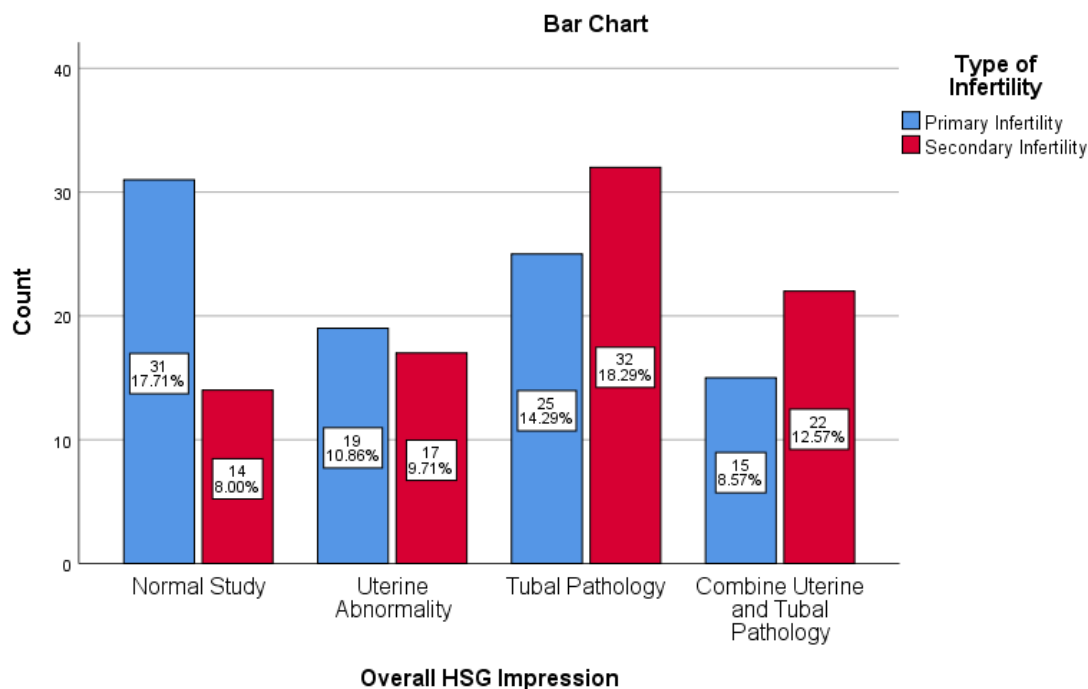
The second most widespread impression was a Normal Study that made up 25.7% (45/175) of the sample. The difference in this category is clear, as 68.9 percent of normal outcomes are the Primary Infertility group, there are only 31.1 percent the Secondary Infertility group. This implies that Primary Infertility cases have much higher probabilities of producing a lackluster HSG results than the Secondary cases. Combined Uterine and Tubal Pathology made up 21.1% of the total with a more prevalent occurrence in Secondary Infertility (59.5%) compared to Primary Infertility (40.5%). Lastly, the Uterine Abnormality was the least common finding (20.6%) and had the most even allocation of findings between the two groups (52.8% Primary vs. 47.2% Secondary) provided.

Table 4. 19

Chi-Square Tests				
		Value	df	Asymptotic Significance (2-sided)
Pearson	Chi-Square	8.581a	3	.035
	Likelihood Ratio	8.747	3	.033
	N of Valid Cases	175		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 17.49.				

Table 4.19 chi-square test

Chi-square test is used to establish the relationship between the variables of the study. The findings indicated that the Pearson Chi-square value was 8.581 and the degrees of freedom (df) of the Chi-square was 3 and p-value was 0.035. As the p-value (0.035) is smaller than the level of significance (0.05), it can be stated that the variables used in the analysis have a statistically significant correlation. The Likelihood Ratio was 8.747 and the p-value was 0.033 that also confirms the statistical significance of the relationship. The Chi-square test revealed that the variables were statistically related to each other ($\chi^2 = 8.581, 3, p = 0.035$). The Chi-square test assumptions were observed to be met because none of the cells had expected count of below 5.



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Figure 4.18 cluster bar chart of overall HSG impression (cross-tabulation)

The Figure [4.18] gives the Hysterosalpingogram (HSG) Impression as a whole under four diagnostic categories, broken down into Primary and Secondary Infertility. The data show that Tubal Pathology has the highest number of diagnoses in general with a percentage of 32.58 percent of the entire sample of the study. Under this category, Secondary Infertility (32 cases) is more dominant than Primary Infertility (25 cases) with an overall total of 18.29%. Tubal factors are therefore a leading cause of infertility among the cohort of this age group even when it comes to infertility of secondary nature. On the other hand, it was observed that in 25.71% of cases a Normal Study was recorded with a heavy inclination towards Primary Infertility (17.71, 31 cases) as compared to only 8.00% (14 cases) towards Secondary Infertility. This implies that primary infertile women are likely to report with unimpressive HSG findings compared to those of secondary infertile women. The least common individual factor was Uterine Abnormality (20.57%), which is more or less equally represented in Primary (10.86) and Secondary (9.71) categories. Lastly, Combined Uterine and Tubal Pathology was found in 21.14% of the sample, and the rate of occurrence was higher in the Secondary Infertility group (12.57) than the Primary group (8.57). All these findings emphasize that the pathological impressions, in particular, tubal factors tend to be more typical of the Secondary Infertility, whereas the cases of Primary Infertility tend to cause a normal HSG impression.

Table 4. 20

Right Fallopian Tube	Primary Infertility (n=90)	Secondary Infertility (n=85)	Total (n=175)
Patent	61 (58.7%)	43 (41.3%)	104 (59.4%)
Proximal Block	15 (34.9%)	28 (65.1%)	43 (24.6%)
Distal Block	14 (50.0%)	14 (50.0%)	28 (16.0%)
Total	90 (51.4%)	85 (48.6%)	175 (100%)

Table 20: Right Fallopian Tube Status by Type of Infertility (Crosstabulation)

The crosstabulation demonstrates the correlation between status of right fallopian tubes and type of infertility among the participants of the study (n =175). Sixty-one (58.7) out of 104 women with a patent right fallopian tube had primary infertility and 43 (41.3) infertility secondary. In women with proximal block of right fallopian tube (n = 43) 15 (34.9) had primary infertility, but a larger percentage, 28 (65.1), had secondary infertility. In the case of distal block (n = 28), the ratio was also the same, and there were 14 (50.0) in primary and 14 (50.0) in secondary infertility cases. All in all, the sample population consisted of 175 individuals of whom 90 (51.4) were primary and 85 (48.6) were secondary infertile individuals. The results indicate that the fallopian tubes with patent rights were more prevalent among women with primary infertility whereas the proximal blockage was more common among women with secondary infertility.

Table 4. 21

Chi-Square Tests				
		Value	df	Asymptotic Significance (2-sided)
Pearson	Chi-Square	6.908a	2	.032
	Likelihood Ratio	6.981	2	.030
	N of Valid Cases	175		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.60.				

Table 4.21 chi-square test

The chi-square test conducted to determine the relations of the right fallopian tube status and type of infertility among the research participants. The findings revealed that the value of Pearson Chi-square was 6.908 with 2 degrees of freedom (df) with the p-value of 0.032. As the p-value (0.032) does not exceed 0.05, then it means that the association between the right fallopian tube condition and the infertility type is statistically significant. The Likelihood Ratio was 6.981 and had a p-value of 0.030 and the statistical significance of the association is also confirmed. Also the assumptions of Chi-square test were also satisfied because no cell had an expected count less than 5 and the lowest expected count per cell was 13.60 which means that the results are valid. The Chi square test showed that there was statistically significant interaction between the right fallopian tube status and infertility type ($\chi^2 = 6.908, 2 = df, p = 0.032$).

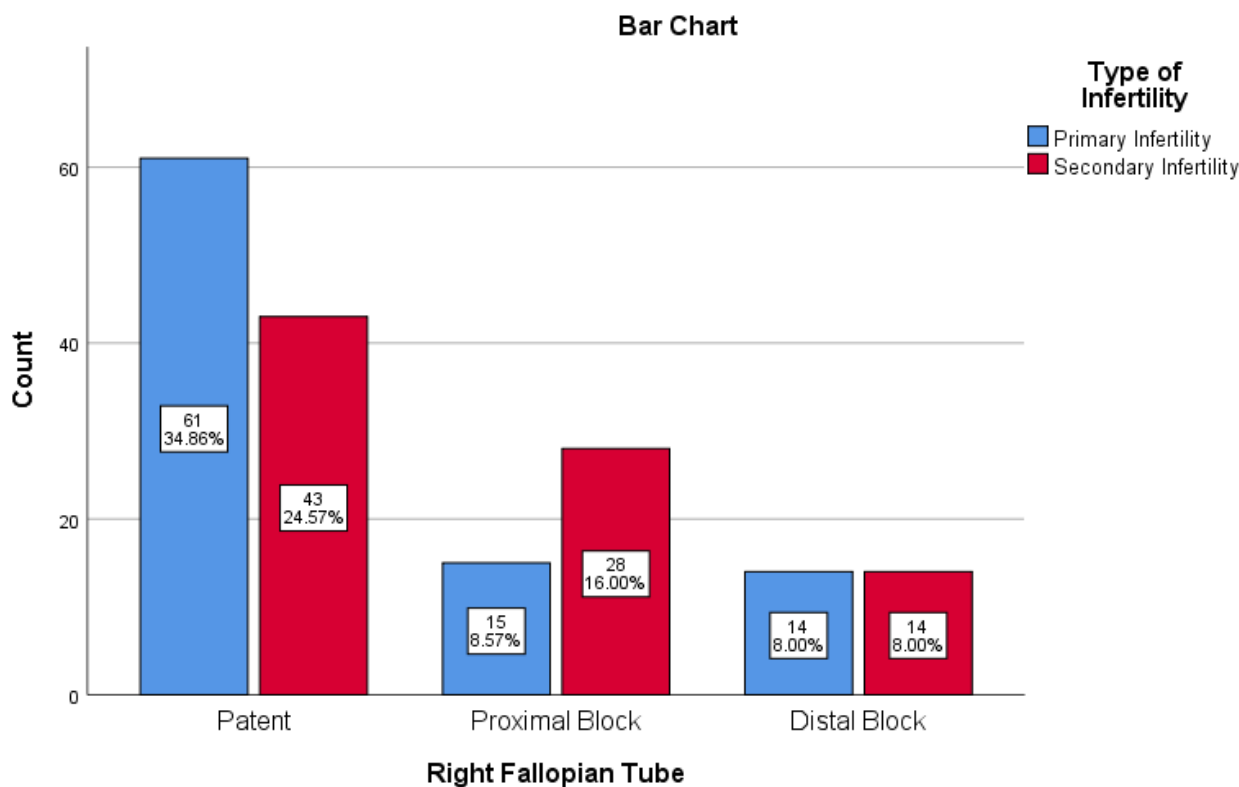


Figure 4. 19

Figure 4.19 cluster bar chart of the right fallopian tube (cross-tabulation)

The Figure [4.19] describes the position of the Right Fallopian Tube (Patent, Proximal Block, or Distal Block) in comparison to the classification Primary and Secondary Infertility. In line with the other observations made before, the most common observation is a Patent right fallopian tube, which is present in 59.43% of the total cases. Primary Infertility occurs significantly higher at 34.86% (61 cases) than Secondary Infertility which is at 24.57% (43 cases). The discussion of tubal blockages shows that Proximal Block is the most notable pathologic result of the right side with a percentage of 24.57 of the sample. The difference in this category is clearly noticeable: The Proximal Block is almost twice frequent in the category of Secondary Infertility cases (16.00%). Conversely, the lowest prevalence is Distal Block as it represents 16.00% of the entire population and an equal distribution of 8.00% (14 cases each) of Primary and Secondary Infertility. These findings show that although the most common state is patency, the Proximal Blocks on the right-hand side are statistically linked to Secondary infertility, whereas the Distal Blocks seem to be proportional in frequency to either type of infertility.

Table 4. 22

Left Fallopian Tube	Primary Infertility (n=90)	Secondary Infertility (n=85)	Total (n=175)
Patent	61 (53.5%)	53 (46.5%)	114 (65.1%)
Proximal Block	10 (35.7%)	18 (64.3%)	28 (16.0%)
Distal Block	19 (57.6%)	14 (42.4%)	33 (18.9%)
Total	90 (51.4%)	85 (48.6%)	175 (100%)

Table 4.22: Left Fallopian Tube Status by Type of Infertility (Crosstabulation)

The crosstabulation shows the correlation of the left fallopian tube status and type of infertility among the research participants (n = 175). In a group of women that had a patent left fallopian tube (n = 114) 61 (53.5%) were infertile by primary, and 53 (46.5%) were infertile by secondary means. In patients having proximal obstruction of the left fallopian tube (n = 28) 10 (35.7) had primary infertility, and a larger percentage, 18 (64.3), had secondary infertility. In the group of women with distal blockage (n=33), 19(57.6) women were primarily infertile and 14 (42.4) infertile secondary. In total, among 175 respondents, 90 (51.4 percent) were having primary infertility and 85 (48.6 percent) were having secondary infertility. The findings show that patent left fallopian tubes were a little more common with women who have primary infertility and a proximal blockage was seen more often with women who have secondary infertility.

Table 4. 23

Chi-Square Tests				
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	3.465a	2	.177	.187
Likelihood Ratio	3.497	2	.174	.187
Fisher's Exact Test	3.424			.187
N of Valid Cases	175			
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.60.				

Table 4.23 chi-square test

The participants were subjected to a Chi-square test that was aimed at assessing the relationship between left fallopian tube status and type of infertility. The Pearson Chi-square value obtained was found to be 3.465 and the degree of freedom (df) was 2 and the p-value was found to be 0.177. The value of the p-value (0.177) is larger than the value of the significance level (0.05), which means that there is no statistically significant relationship between the left fallopian tube condition and the type of infertility in this population sample. The Value of Likelihood Ratio was 3.497 with a p-value value of 0.174 that corroborates the null hypothesis of no significant relationship. Moreover, the assumptions of the Chi-square test were satisfied since no cells had the expected count of less than 5, and the lowest expected count was 13.60 meaning that the outcomes of the test are valid. The Chi-square test indicated that there was no statistically significant correlation between the status of the left fallopian tube and the type of infertility (2df=3.465, p=0.177).

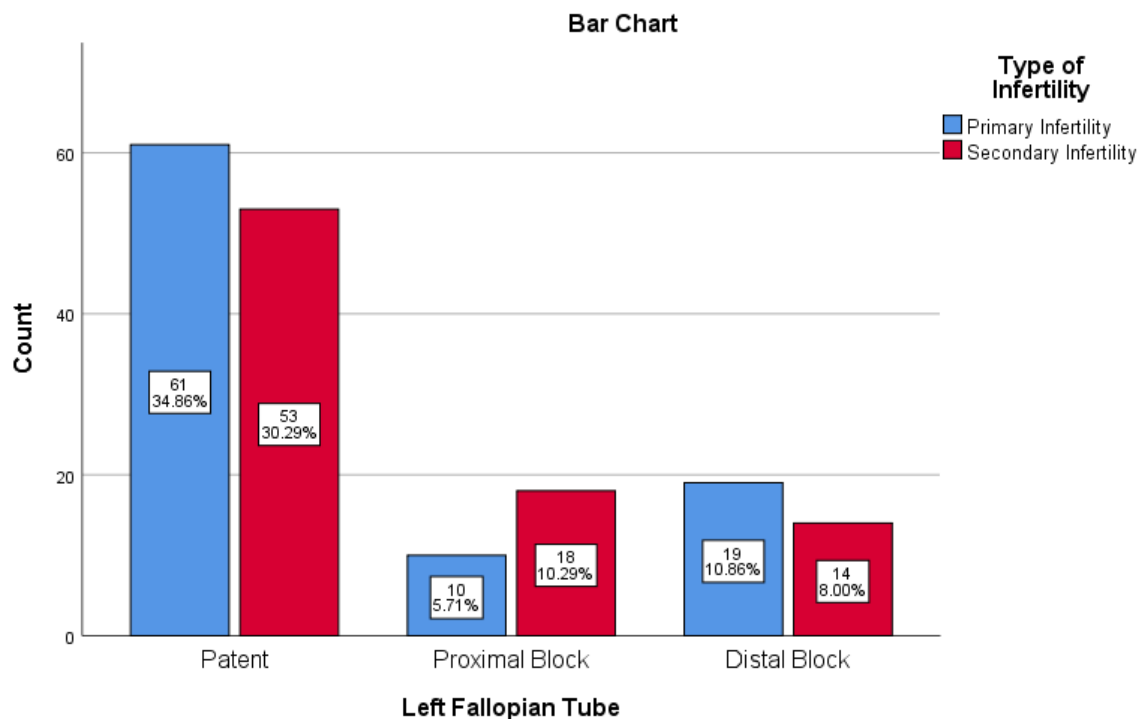


Figure 4. 20

Figure 4.20 cluster bar-chart of the left fallopian tube (cross-tabulation)

The figure [4.20] illustrates the patency and blockages of Left Fallopian Tube in a sample of a study population based on the infertility type. The data shows that the most common of them is a left fallopian tube Patent (open), which includes 65.15% of the total. In this patent group, Primary Infertility constitutes 34.86 (61 cases) and Secondary Infertility constitutes 30.29 (53 cases) which shows that a large majority of the sample does not have tubal obstruction on the left side irrespective of certain infertility classification. Distal Block constitutes the most common form of obstruction as opposed to Proximal Block in terms of pathological findings with a total of 18.86% of the sample. It is interesting to note that Primary Infertility has a greater proportion of Distal Blocks (10.86% as compared to Secondary Infertility (8.00%). On the other hand, the least common overall is Proximal block (16%), but with a specific reversal of the infertility trend: Secondary Infertility is almost twice as prevalent in this category (10.29%), than Primary Infertility (5.71%). Such results indicate that although tubal patency is the default, certain forms of blockages are associated with primary and secondary infertility differently, and proximal obstructions in this particular dataset seem to be more of the secondary infertility group.

Table 4. 24

Uterine Cavity Appearance	Primary Infertility (n=90)	Secondary Infertility (n=85)	Total (n=175)
Normal	64 (54.2%)	54 (45.8%)	118 (67.4%)
Irregular Cavity	26 (45.6%)	31 (54.4%)	57 (32.6%)
Total	90 (51.4%)	85 (48.6%)	175 (100%)

Table 4.24: Uterine Cavity Appearance by Type of Infertility (Crosstabulation)

The Table [4.24] shows the uterine cavity appearance distribution in women with primary and secondary infertility. Among the 175 cases (100%), 118 of the cases (67.4) had normal uterine cavity, and 57 cases (32.6) had irregular uterine cavity. Out of the women whose uterine cavity is normal 64 cases (54.2%) were observed in women with primary infertility and 54 cases (45.8) in women with secondary infertility. This implies that normal uterine cavity was slightly prevalent among the women who had primary infertility. Conversely, 26 (45.6) cases out of 57 women with irregular uterine cavity had primary infertility and 31 (54.4) had secondary infertility. This indicates that abnormal uterine cavity results were slightly greater in infertile women who had secondary infertility. Generally, the findings indicate that the majority of women involved in both infertility groups were found to have a normal uterine cavity, and abnormal cavity was observed in approximately one-third of the total cases, and the secondary infertility was found to have a slightly higher percentage than the primary infertility group.

Table 4. 25

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.144a	1	.285		
Continuity Correction ^b	.825	1	.364		
Likelihood Ratio	1.145	1	.285		
Fisher's Exact Test				.334	.182
N of Valid Cases	175				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 27.69.					
b. Computed only for a 2x2 table					

Table 4.25 chi square test

Chi-square test was employed to test the relationship between the variables in the study where $n=175$ was the total sample size. The Pearson Chi-square value equals 1.144 and the degree of freedom ($df = 1$) is 1 and the p-value equals 0.285 exceeding the standard level of statistical significance ($p < 0.05$). This shows that the variables under analysis are not statistically significant. In the same way, the continuity correction value ($= 0.825$) having a p-value of $= 0.364$ as well as the likelihood ratio test ($= 0.285$) indicate that the relationship between the variables is not statistically significant. This finding is further confirmed by the Fisher Exact Test whose two-sided p-value was 0.334 which is also higher than 0.05, meaning that there was no significant correlation between the variables. The test assumptions were also met since no cells in the test had an expected count of less than 5 and the lowest expected count was 27.69 which indicate that the results of the Chi-square test are valid.

In general, the results indicate that the relationship between the examined variables in this sample of 175 participants is not significant.

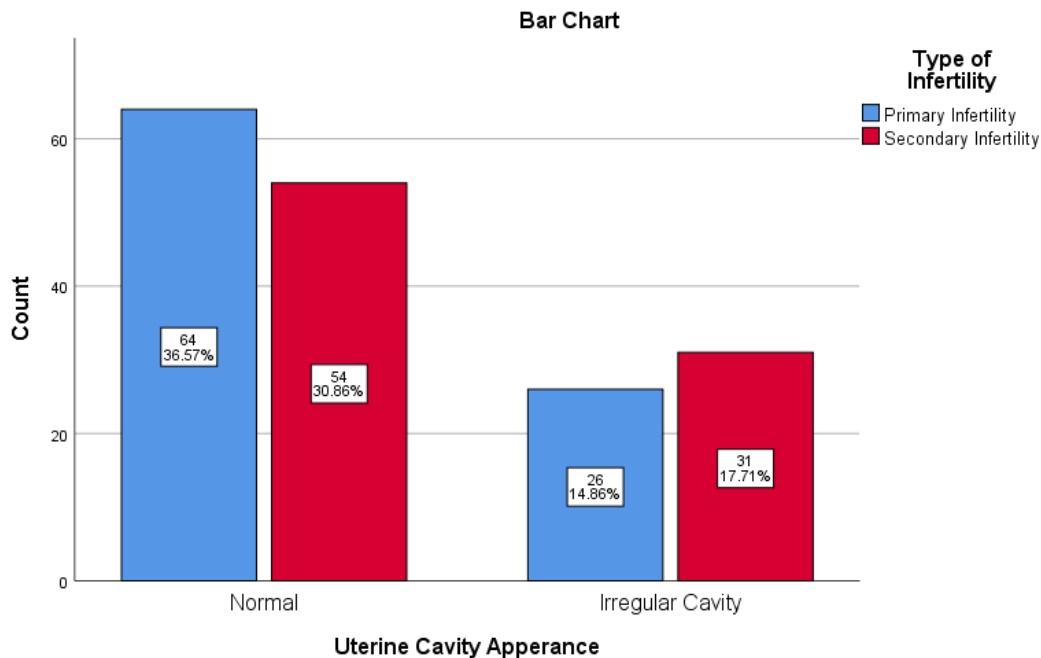


Figure 4. 21

Figure 4.21: cluster bar-chart of uterine cavity appearance

The figure [4.21] shows the correlation between the appearance of the uterine cavity (Normal and Irregular) and the infertility type (Primary and Secondary) in a sample population. The clear majority of the surveyed population is known to possess a Normal uterine cavity which makes up the major part of 67.43 in total cases with Primary Infertility in this category the most common finding of 36.57 (64 cases). In comparison, an Irregular Cavity is not so frequent, constituting 32.57% of the entire sample. Interestingly, the category of infertility varies according to the two appearances of the cavities; whereas Primary Infertility is more common when the cavity appears Normal, Secondary Infertility is more common when the cavity appears Irregular with the frequency being 17.71% (31cases) and 14.86% respectively. Altogether, the information presupposes that though the normal uterine appearance is more prevalent in both types of infertility, the atypical cavities are more related to secondary than primary infertility.

Chapter 5

Discussion

The current research was intended to identify the trends in uterine anomalies and prevalence of tubal obstruction observed in women with primary and secondary infertility in the Punjab population of Pakistan by using hysterosalpingography (HSG). The results give significant information about the demographics, reproductive history and structural reproductive abnormalities in infertile women. The findings, in general, show that tubal pathology and uterine abnormalities are major causes of infertility, and they changed significantly within both primary and secondary infertility groups.

The mean age of the respondents reveals that infertility was the most prevalent among women in the 29-39 years age bracket, and this represented the 60.6% of the mean of the study sample (Table 4.1; Figure 4.1). This indicates that infertility assessment is most commonly requested during the later phases of the reproductive process where couples are actively trying to conceive, and infertility capacity slowly diminishes. These results can be compared to the findings of Shermin et al. (2024), who have also reported that most of the infertile women in the HSG had belonged to the late twenties to early thirties age group. The parallels between these results can be connected to general reproduction trends in the developing world where women tend to visit the doctors after several years of unproductive pregnancy.

In the context of the form of infertility, the current research revealed that primary infertility was slightly more widespread than secondary infertility, 51.4 and 48.6 of cases respectively (Table 4.2; Figure 4.2). This result is in line with the findings of Khanal et al. (2023) and Rabbani Begum et al. (2025) that have also reported higher rates of primary infertility among the study groups. This is however the opposite of what is reported by Oyedepo et al. (2025) and Bobmanuel et al. (2023) who found secondary infertility to be more prevalent in the contexts of their study. These variations can be explained by the differences in the sociocultural practices, reproductive health awareness, obstetric history, and access to healthcare services by different populations.

The patterns of infertility care seeking are also supported by the duration of infertility in the participants. Most of the women in this study have reported infertility of 15 years (72.6) (Table 4.3; Figure 4.3) and this means that most couples would consult with the medical authorities during the first years of unsuccessful conception. Those trends have been observed in earlier studies with

reports of infertile women availing themselves to be assessed within the first five years of infertility. Early medical care can enhance the chances of a diagnosis of treatable causes and the introduction of the correct treatment.

Menstrual characteristics are also very critical in giving information on reproductive health amongst the participants. In the current research, most women have been found to have regular menstrual cycles (72%) (Table 4.4; Figure 4.4), irregular cycles were noted in about a quarter of the respondents. In the same way, the most frequent length of the menstrual cycle was 22-25 days (48.6) (Table 4.5; Figure 4.5), which is within the physiologically healthy range of menstrual cycle in reproductive-age women. These results imply that infertile women still could exhibit normal menstrual cycles meaning that structural or tubal causes and not ovulatory dysfunction might contribute more to infertility among this group.

The participants were mostly aged between 10 and 12 (45.7) years of age at menarche (Table 4.6; Figure 4.6), indicating that it is in conformity with the physiological age of menstruation in South Asian adolescent girls. In certain studies, early or delayed menarche is linked to reproductive health complication; in this case, most of the participants had a normal distribution of menarche age.

The rest of the gynecological and obstetric histories were also taken to have a clue about the possible risk factors contributing to infertility. The history of dysmenorrhea was reported among 31.4% and the general majority of study participants did not report such issues (Table 4.7; Figure 4.7). Also, a majority of women had no abortion or miscarriage history (62.9) (Table 4.8; Figure 4.8), though, the proportion of women who had one or more miscarriage was significant. In several studies, secondary infertility is linked with previous pregnancy loss and can be the sign of underlying abnormalities of the uterus and hormones.

On the same note, the history of ectopic pregnancy reported 21.1 percent in the participants (Table 4.9; Figure 4.9). Ectopic pregnancy is an established risk factor that causes tubal damage and consequent infertility as it can cause fallopian tube scarring or obstruction. Nonetheless, most participants of the present study had no ectopic pregnancy history. The surgical history of the study participants indicated that the majority of the women did not have any previous surgical operations (80.6%) (Table 4.10; Figure 4.10) though there was also a low level of minor diagnostic procedures

and tubal surgeries. In other studies, tubal adhesions and infertility have been linked with previous pelvic surgeries and this is possibly the reason why some of the participants had tubal pathology.

The assessment of the appearance of the uterine cavity showed that most of the participants (67.4) had a normal uterine cavity; irregular appearances of the uterine cavity were seen in participants (32.6) (Table 4.12; Figure 4.12). The above findings agree with the findings by Khanal et al. (2023) and Rabbani Begum et al. (2025) who also showed that the majority of infertile women undergoing HSG had normal morphology of the uterine cavity. Nevertheless, the irregular cavities of the uterus found in almost one-third of the subjects implies that the structural malformation of the uterus is a significant determinant of infertility.

The study of congenital anomalies of the uterus also showed that the majority of the participants had no congenital abnormalities (73.7%) (Table 4.13; Figure 4.13). In the anomalies, arcuate uterus was the most prevalent (19.4%), then unicornuate and bicornuate uterus. The results agree with the existing literature that arcuate uterus is among the most common minor congenital uterine anomalies that are observed during HSG tests.

The frequency of tubal blockage of infertile women was among the main aims of the current research. The findings show that the majority of the participants possessed patent fallopian tubes in both sides, yet there is a significant percentage that presented with tubal obstructing. In the case of the right fallopian tube, 59.4% of the participants had the patency of the fallopian tube and 24.6 and 16% had proximal and distal blockages respectively (Table 4.14; Figure 4.14). On the same note, with the left fallopian tube, 65.1% of the participants had their fallopian tubes patent and 16 and 18.9% had proximal and distal obstructions respectively (Table 4.15; Figure 4.15). These results support the importance of tubal pathology in infertility.

Peritoneal spill assessment also revealed that bilateral free spill was observed in 45.7% of the participants, unilateral spill in 31.4% and none in 22.9% (Table 4.16; Figure 4.16). The outcomes of these studies show that the majority of participants had a certain level of tubal patency although almost a quarter of them had total bilateral tubal blockage, which is one of the primary mechanical infertility causes. Other past researchers have reported similar results, and the obstruction of tubes was found to be one of the most prominent causes of infertility observed with the help of HSG.

The general HSG results in this research were that the abnormal results were more prevalent than the normal ones. Participants who had a normal HSG study were 25.7% and a total of 74.3% had abnormalities (Table 4.17; Figure 4.17). The most common abnormality was the tubal pathology (32.6%), and the second was combined uterine and tubal (21.1) pathology and third (20.6) was isolated uterine abnormalities. These findings are not isolated because findings by Kayani et al. (2024) also found that tubal pathology was the most frequently identified abnormality in HSG in infertile women.

On the comparison of the HSG results of the primary and secondary infertility groups, the current study established a significant difference. Tubal pathology and combined uterine-tubal abnormalities were also more common in women with secondary infertility whereas normal HSG results were more common in women with primary infertility (Table 4.18; Figure 4.18). This observation confirms past-reports on the same that Aryal et al. (2025) made, who also established that tubal abnormalities have a stronger relationship with secondary infertility. Secondary infertility has been attributed to past obstetric history, or pelvic infection or even the surgery that could damage the fallopian tubes.

Statistical results also showed that there was a significant correlation between the general HSG results and the infertility type ($\chi^2 = 8.581$, $p = 0.035$) (Table 4.19). Also, the status of the right fallopian tube was statistically significant with infertility type ($\chi^2 = 6.908$, $p = 0.032$) (Table 4.21), indicating that the right-Sided tubal obstruction could be a significant contributor to infertility patterns. But it was not found that there was a statistically significant correlation between left fallopian tube and infertility type ($p = 0.177$) (Table 4.23). On the same note, the appearance of the uterine cavity was not significantly correlated with infertility type ($p = 0.285$) (Table 4.25). These results indicate that structural uterine abnormalities do exist in the infertile women, but that tubal pathology is perhaps a more powerful predictor of infertility type among the infertile population.

In conclusion, the findings of the ongoing study indicate that abnormal findings of HSG people are common in infertile females of group Punjab and tubal pathology is most common. The greatest number of the participants had their normal uterine anatomy, but a large percentage of the participants had their abnormalities of the uterine cavity and congenital anomalies. Tubal blockage particularly proximal blockage was more easily attributed to secondary infertility and this created

the possibility of tubal integrity having been compromised in previous reproductive events. These results demonstrate the importance of hysterosalpingography as a powerful and cost-effective diagnostic tool that may be implemented to determine the role of the uterine and tubal factors in infertility and in particular in a resource-starved country such as in Pakistan.

Conclusion

The paper was a review of the trend of uterine abnormalities and the prevalence of tubal blockage among women with primary and secondary infertility in one of the tertiary care hospitals in Punjab, Pakistan, on the basis of hysterosalpingography. The findings provide a good source of data on the structural reproductive variables that cause infertility among the members of the study population.

The results showed that infertility was common among females aged 29-39 years and this means that, infertile women should also undergo a test of infertility at advanced age when they are already in the advanced age.

fertility potential declines gradually. The population of study was relatively higher in terms of primary infertility than secondary infertility and the two were practically equal.

The majority of the respondents were of normal menstrual cycle, and normal period of the menstrual cycle, which implies that ovulatory dysfunction was not the primary source of infertility in the majority of women in this cohort. Instead, a significant role appeared to belong to structural defects of the reproductive tract. The outcome of the hysterosalpingography revealed that though most women had the right cavity of the uterus, a good proportion of the women had abnormalities and congenital anomalies of the uterine cavity, with arcuate uterus being the most prevalent. However, tubal pathology was the most common abnormal outcome of the research.

Most of the participants had obstruction of the tubes adjacent and distant to the ovary with or without obstruction of one or both fallopian tubes. Findings of the peritoneal spill also proved the fact that despite the sufficient numbers of women with certain levels of tubal patency, nearly a quarter of the respondents had bilateral tubal occlusion that is one of the most common causes of infertility by mechanical mechanisms.

In the comparison of primary and secondary infertility groups, it was discovered that, the abnormal HSG findings involving tubal pathology and a combination of abnormality in the uterus and the tubules were prevalent in the secondary infertile women. This means that the secondary infertility may be highly due to the trauma of the reproductive tract which is incurred in the past infection cases, obstetric issues or even during surgery.

Altogether, the findings point to the fact that hysterosalpingography is a useful, accessible, and cost-effective diagnostic method that could be employed to diagnose the cases of abnormalities in the uterus and tubes in infertile women. One can apply early diagnosis of such anomalies to establish the appropriate clinical intervention, medical therapy, surgery or artificial conception.

The position of augmenting the services of infertility diagnosis and urging early infertility screening is, therefore, to maximize the reproductive outcomes and reduce the burden of infertility of women in Pakistan and other resource-limiting settings.

Limitations

This study provides valuable insights into patterns of uterine abnormalities and tubal blockage among infertile women; however, several limitations should be considered. The research was conducted in a single clinical setting in Punjab, Pakistan, which may limit the generalizability of findings to other regions and populations with different demographic and healthcare characteristics. The cross-sectional design restricts the ability to establish causal relationships between reproductive abnormalities and infertility outcomes. Additionally, although hysterosalpingography (HSG) is a commonly used diagnostic tool, it has limitations in detecting conditions such as pelvic adhesions, endometriosis, and subtle tubal dysfunction, and may also produce false positives due to tubal spasm. The reduced sample size from 218 to 175 participants due to dropouts and missing data may have slightly affected the statistical power. Furthermore, the absence of confirmatory diagnostic techniques like laparoscopy, hysteroscopy, or transvaginal ultrasound may have limited diagnostic accuracy. Lastly, the study focused only on female factors and did not account for male infertility, which is also an important contributor to infertility in couples.

Recommendations

The findings of this study suggest several important recommendations for future research and clinical practice. There is a need for large-scale multicenter studies across different regions of Pakistan to improve the generalizability of results and better understand national infertility patterns. Future research should adopt longitudinal or prospective designs to establish causal relationships between reproductive abnormalities and infertility outcomes. Clinically, HSG findings should be complemented with diagnostic modalities such as laparoscopy, hysteroscopy, and transvaginal ultrasound to enhance diagnostic accuracy. Early infertility assessment and counseling should be prioritized to improve treatment outcomes and reduce psychological and financial burden. Additionally, future studies should explore the role of hormonal factors, particularly FSH and LH levels, in infertility. Lastly, public health efforts must focus on increasing awareness, promoting early diagnosis, and improving access to infertility services, especially in low-resource settings.

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APPENDICES

Appendix A Consent form

Dear Participant,

You're invited to participate in research. Your privacy and confidentiality will be upheld for the entire study. There would be no risk of injury to your body. Your signature confirms your understanding and voluntary participation.

Participant's Signature: _____

Researcher's Signature: _____

Date: _____

Appendix B



Research Questionnaire Proforma for Hysterosalpingography (HSG)

Study Title: Patterns of Uterine Abnormalities and Frequency of Tubal Blockage on Hysterosalpingography among Women with Primary and Secondary Infertility

Section A: Demographic Information

1. Age (in years)

18-28

29-39

40-45

Section B: Clinical History

2. Type of infertility: Primary Secondary

3. Duration of infertility (years): _____

4. Menstrual cycle:

Regular Irregular

Average cycle length (days): _____

5. History of dysmenorrhea: Yes No

6. Menarche age (Years)

7-9

10-12

13-16

Section C: Obstetric and Gynecological History

7. Number of abortions/miscarriages: _____

8. History of ectopic pregnancy: Yes No

9. Previous pelvic or abdominal surgery: Yes No

If yes, specify: _____

Section D: Relevant Medical History

10. History of urinary tract infection: Yes No

Section F: Hysterosalpingography Findings

Uterine Cavity

regular cavity

Irregular cavity

Congenital anomaly

Arcuate

Bicornate

Uterus didelphys

Septate

Unicornate

Normal

Fallopian Tubes

11. Right fallopian tube:

Patent

Proximal block

Distal block

12. Left fallopian tube:

Patent

Proximal block

Distal block

13. Peritoneal spill:

Bilateral free spill

Unilateral spill

No spill

Section G: Summary Impression

14. Overall HSG impression:

Normal study

Uterine abnormality

Tubal pathology

Combined uterine and tubal pathology



UMT

For Official Use Only:

Date: Reference no.
RE-04-2026
11-02-2026

Research Ethics Screening Form

Do you need ethics approval?

Looking through this checklist will help you to decide whether you are required to seek ethics approval for your research. You are advised to discuss your project, methods and ethical issues with your project/research supervisor before looking at this checklist.

Does your intended research include any of the following methodologies?

- 1. Interviews or oral histories
- 2. Questionnaires or surveys
- 3. Analysis of any kind of social media
- 4. Ethnography or observation
- 5. Any other methodology that involves animal and live human participants or their data?

If you said yes to any of the above, then you will require ethics approval for your project. Please complete the Research Approval Form on page # 2.

If you said no to all above 5 Questions then you do not require ethics approval form. Please get this form verified and signed by your research supervisor and COD and attach this in your thesis annexure.

If you are required to submit an Ethics Review Form, you should not begin your research until your form has been approved by the Research Ethics and Support-Committee.

Approved By [Signature]
Research Supervisor
Date: 10-02-2026

Approved By [Signature]
Chairman of Department
Date:
Arifa Nabeen
Assistant Professor & Acting Chairperson
Medical Imaging Department (SHS)
University of Management and Technology



UMT

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Date: Reference

RESEARCH ETHICS APPROVAL FORM

(For Scientists/Researchers/Students)

Who Should Complete it?

This form should be completed by all participants, faculty and staff seeking ethics approval for their research to be undertaken at University of Management and Technology. All sections of the form must be completed and submitted to the ORIC at least three weeks prior to the start of their research.

Section 1: <u>DETAILS OF RESEARCH PARTICIPANT</u>									
UMT Participant Research Project	<input checked="" type="checkbox"/>								
UMT Faculty/Staff Research Project	<input type="checkbox"/>								
Other If other please specify:	<input type="checkbox"/>								
Name of The Researcher/Scientist/Participant:	<table border="0"> <tr> <td>Noor Ul Ain S2022244014</td> <td>Abdul Mateen S2022244104</td> </tr> <tr> <td>Hadia Hafeez S2022244064</td> <td>Jawad Shahbaz S2022244082</td> </tr> <tr> <td>Mishma Mahmood S2022244031</td> <td>Muneeb Nasir S2022244071</td> </tr> </table>	Noor Ul Ain S2022244014	Abdul Mateen S2022244104	Hadia Hafeez S2022244064	Jawad Shahbaz S2022244082	Mishma Mahmood S2022244031	Muneeb Nasir S2022244071		
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Mishma Mahmood S2022244031	Muneeb Nasir S2022244071								
Department/School: Medical Imaging and Ultrasonography, School of Health Science									
Email	Mobile:								
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Supervisor's Name: Qurat Ul Ain Affiliation Institution/clinic and position of research supervisor: Assistant professor Department	Supervisor's Department: Medical imaging and ultrasonography Supervisor's contact/ email and/or telephone no: curat.ain@umt.edu.pk								

Section 3:

DETAILS OF RESEARCH METHODOLOGY

6. What are the type of your research and/or data collection methods:

Type of research	DATA COLLECTION METHODS				
	Experimental (laboratory)	Observational (non-interventional)	Epidemiologic	Quantitative	Qualitative
<input type="checkbox"/> In vitro	<input type="checkbox"/> Clinical case report	<input type="checkbox"/> Cross-sectional	<input type="checkbox"/> Anonymous	<input type="checkbox"/> Semi-structural interview	
<input type="checkbox"/> In vivo	<input type="checkbox"/> Meta-analysis	<input type="checkbox"/> Cohort study	<input type="checkbox"/> Correlati onstudy	<input type="checkbox"/> Quantitati vedata analysis	
<input type="checkbox"/> Secondary analysis of biological material	<input type="checkbox"/> Prospective	<input type="checkbox"/> Case control	<input type="checkbox"/> Secondar y data collection	<input type="checkbox"/> Focus group	
<input type="checkbox"/> Secondary analysis of biological samples	<input checked="" type="checkbox"/> Retrospective	<input type="checkbox"/> Systematic data analysis	<input checked="" type="checkbox"/> Quantitati ve content analysis	<input type="checkbox"/> Case study	
Other please specify the type of your research and/or data collection methods					

7. What is the object of your research?

- Humans please specify (for example, patients, health professionals etc.). COVID-19 patients both current and recovered
- Anonymized health data (information), available in official databases, registries, medical history or archives (proceed to question no. 14) Please specify the criteria for information selection (for example, ICD codes etc.)
- Human biological samples (proceed to question no. 14) Please specify the criteria for sample selection
- Animal biological samples
- other Please specify

8. Does your research involve vulnerable individuals or groups?

- No
- Yes (mark or specify vulnerable groups below)
- Minorities
- Incompetent patients
- Pregnant women
- Competent persons with certain limitations of decision making
- Refugees
- Prisoners
- Students
- Soldiers in the active military service
- Other

Please argue and comment whv the mentioned vulnerable groups or individuals should be included in vo

9. What is the sample size of your research? Please enter the number of research participants and justify it (please explain how you will determine the sample size?)

218 Sample size by using RaoSoft

Section 4: DETAILS OF RESEARCH INSTRUMENT

10. Will you employ any kind of questionnaires for data collection in your research?

- Yes, I will use a standardized questionnaire and the authors' permission for its usage in my research is received.
Please attach the document that proves the permission to use the questionnaire attached with synopsis
- Yes, I will use a standardized questionnaire with free copyright (permission is not required)
Please include the evidence that the questionnaire is free to use
- Yes, I will use an originally developed questionnaire
Please attach the copy of an originally developed questionnaire
- No, I will not use any questionnaire
- Other please specify and comment

11. What type of a survey will you be using?

- Face-to-face interview
- Other, please specify

Through - Exams, reports and Patient Prescription -

Section 7: DATA PROTECTION

21. Please provide details of where the data will be stored?

Questionnaire
From paper to soft form excel sheet

22. How long the data will be retained?

5 years

10 years

23. Any other approval required?

YES

NO

IF YES PLEASE SPECIFY:

Section 8: Statement of Ethical Commitment:

I Noor Ul Ain, Hadia Hafeez, Mishma Mahmood, Abdul Muneeb Nasir, Mateen, Jawad Shahbaz pledge the commitment that all rules set by the ethical policy are followed in my research process. I also make a commitment to abide by ethical principles, moral values, law and instruction of the institutions. My research carries no bias for ethnicity, gender, regional aspects and is totally impartial and objective. I have taken informed consent from participants, participation; is on a voluntary basis and no force of any kind has been used to attract the participants.

[Handwritten signatures]
Signature of Researcher/Scientist/Student

Endorsed By	Reviewed by Manager ORIC	Approved By
<p>Project Supervisor & Dean</p> <p>Name of Project Supervisor: Qurat Ul Ain</p> <p>Signature: <i>[Signature]</i></p> <p>Name of School Dean: Prof Dr Muhammad Salman Bashir</p> <p>Signature: <i>[Signature]</i></p> <p>Stamp: <i>[Stamp]</i></p>	<p>Name: Naveed UlHaq</p> <p>Signature: <i>[Signature]</i></p> <p>Stamp: <i>[Stamp]</i></p>	<p>Chairman Research Ethics & Support Committee (RESC)</p> <p>Name: Dr Ejaz Ullah Cheema, Dean Pharmacy</p> <p>Signature: <i>[Signature]</i></p> <p>Stamp: <i>[Stamp]</i></p>

[Faint stamp: Prof. Dr. Muhammad Salman Bashir (PhD), Director of Health Science (HS), University of Management & Technology]

[Faint stamp: Chairman Research Ethics and Support Committee (RESC), Office of Research Innovation and Commercialization, University of Management and Technology, Lahore]