



A STUDY OF THE COST OF IVF PROCEDURE AT ASSISTED REPRODUCTIVE TECHNIQUE CENTRE

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ABSTRACT

Objective

This descriptive study aims to study the cost of IVF procedure at Assisted Reproductive Technique Centre.

Methods:

A total of 70 IVF procedures were included in the study which took place for a period of 12 months from the month of January 2022 to December 2022 and data were collected from the records maintained in the ART centre, Medical Records Department, Accounts department, pharmacy department, Purchase and stores department. This study primarily examined two aspects of the ART centre such as the physical facilities available and the staffing pattern within the IVF centre.

Results

This study found out that the total cost per cycle of ICSI was 8.3% higher than that of IVF. This discrepancy can be owing to various factors such as the higher costs of medications and the additional laboratory processes involved in ICSI. By conducting this cost analysis, the researchers provided valuable insights into the financial aspects of IVF and ICSI treatments. This study found that the total cost per IVF procedure was Rs.1, 00,743, with staff salaries accounting for 59.62% of the cost. Comparing the cost per procedure to the national average, it falls within the range. However, the study revealed that the fee for the natural stimulant 1st cycle was significantly lower than the hospital's cost per procedure. To make IVF more accessible to lower socioeconomic groups, it is recommended to increase the number of procedures rather than raising the cost.

Conclusion:

Understanding the specific cost breakdown of these procedures can assist healthcare providers, policymakers, and patients in assessing the economic implications and making informed decisions regarding fertility treatments.

Keywords: Cost of IVF, Assisted Reproductive techniques, infertility, Reproductive healthcare, Cost analysis of ART.

INTRODUCTION

Assisted reproductive technology (ART) has grown rapidly in the last few years. ART is given for infertile couples which are considered as a milestone in the medical world (1). Technically, infertility is defined as the inability to conceive following a year of regular, unprotected sexual contact between the pair. (2) According to WHO, infertility is defined as the failure of the male or female reproductive system to attain pregnancy after 12 months or more of regular unprotected sexual intercourse. According to the research, one in six persons struggle with infertility, highlighting the critical need to expand access to high-quality, reasonably priced fertility care for those who are in need(3). While one in four couples in underdeveloped nations experience infertility(4) The prevalence of primary infertility in India is around 3.9% (age-standardized to 25-49 years) and 16.8% (age-standardized to 15-49 years) using the "age but no birth" criterion (5). Assisted reproductive technology has progressed tremendously due to an increase in the rate of infertility and it was estimated that around 5 million children were born due to ART worldwide (6,7). In developing countries like India, the concept of infertility is moulded by patriarchy but the extent of male dominance varies according to social and religious beliefs. Past researchers have demonstrated that women who are infertile are subjected to extreme rejection from their family members and husbands and because of this they experience increased levels of stress (8, 9)

A community-based study conducted by Katole A et.al (2019), showed the prevalence of primary infertility and its associated risk factors in an urban population of Central India. 7 They found out that around 39.3% of the women were between 25–29 years of age and the overall prevalence of primary infertility among reproductive age group women was 8.9%. Socio demographic factors such as increased age during the marriage, nuclear family, higher socioeconomic status, and education level were significantly correlated with infertility along with familial history of infertility. They have found that psychological factors such as depression and stress were associated with infertility (10).

According to Eugster et.al in 1999 reported that people that undergo treatment by IVF were more stressed than people with normal fertility (11). In an interview conducted in 2001 among 65 infertile couples, it was confirmed that in all the cases, it was the female partner who commenced the treatment (12).

Sadock B.J et.al reported that male and female infertility contributes around 40% each and 20% of cases are due to problems with both sexes (13). Current research in India states that around 50% of infertility is due to reproductive disorders and abnormalities in males and adding on about 25% of infertility is termed as unexplained infertility leaving the cause unknown (14).

Mustafa M et.al, (2019) studied the causes and management of Male and female infertility. Infertility could be due to male or female or an unknown cause. Generally, ovulatory problems in females and the quality of semen in males are the common reason. STD, metabolic syndrome, and hormonal imbalance are the additional causes. They have proposed that if the traditional treatment is not successful, doctors can advise their patients for IVF and ART since it has promising good results (15).

Deshpande PS et.al, (2019), studies the causes and prevalence of factors causing infertility in a public health facility. They found that primary infertility (57.5%) was more in number than secondary infertility (42.5%). PCOS is the leading cause of infertility (46%) in females and it was noticed equally both in lean as well as obese PCOS females. Pelvic inflammatory disease and tuberculosis are the two main culprits for infertility related to tubal factors. The cause of fertility changes as the years of marriage increase, in the initial years PCOS in females was the cause but in later years male factor and unexplained fertility were the reasons. 20% of the cases are related to male infertility. Abnormal semen in males was associated with tobacco and alcohol consumption (16).

A cross-sectional study conducted by Sudha G et.al (2013), revealed the causes of female infertility. In that study, a total of 635 females were recruited. The subjects were divided into five groups based on the years of infertility such as 1-2 years, 3-4 years, 5-9 years, 10- 14 years, and > 15 years. The tubal block was the main reason in the 1-2 years of infertile group and ovulation and uterine causes were the main reason in > 15 years period of the infertile group. In 5-9 yrs and >15yrs groups, obesity, and overweight were the prime reason of infertility. The lower income group avoids seeking medical help due to increased expenses. When examined in detail, about 30% of females needed medical aid, 65% were normal and only 5% are refractory in nature. They have concluded that female infertility can be treated and managed with medication, minor surgical operations, laparoscopic procedures, hormonal therapy, and prevention of preconception failure and maintenance of a healthy lifestyle(17).

Malhotra N et.al, (2013) conducted a retrospective data analysis study on assisted reproductive technology in India. The study portrays that the increase in the number of clinics and the number of ART cycles performed every year has been exponential. There were only 5500 cycles of IVF-ICSI were performed in 2000 in India and this tremendously increased to 21,500 in the year 2006 and 110,000 in 2011 (18)

IUI and IVF's cost-benefit analyses were based on a willingness-to-pay method in research by Darvishi A (2020). In this investigation, 604 samples from two groups—IUI and IVF— were used. One round of IUI or IVF averaged 19561140 and 60897610 IRR in direct and indirect medical expenditures, respectively. Additionally, the mean WTP for IVF and IUI procedures was found to be 15941061 and 28870833 IRR, respectively. The demand for IUI and IVF procedures was flexible, and the public was sensitive to changes in

these procedures' costs. Economic factors had the greatest influence on the WTP and community preferences, demonstrating the substantial significance of financial restrictions, while IUI and IVF procedures did not bring any positive net advantages (19)

In vitro fertilization and intra cytoplasmic sperm injection treatments were thoroughly cost analyzed by Bouwmans CA et al. in 2008. The average expenses of IVF and ICSI hormonal treatment were €1630 and €1585, respectively, whereas the prices of oocyte retrieval were €500 and €725. Given that hormonal stimulation accounted for the majority of a cycle's expenditures, IVF and ICSI, on average, cost 68% and 61% more each cycle, respectively, than IVF and ICSI, due to the comparatively high cost of medicine. Regardless of the method of therapy (IVF or ICSI), the cost of medicines rose as the women's ages did. IVF and ICSI's respective total expenditures for fertilization (IVF laboratory) were 12% and 20%, respectively. According to this study's findings, ICSI cycles overall cost 8.3% more than IVF cycles (20).

Teoh PJ.et.al, (2014) analyzed about the current insights of low-cost in vitro fertilization. A simplified culture system is the most noteworthy invention in decreasing the cost of IVF by around 90%. They have suggested that low-cost medication for stimulation of the ovary can be chosen for lower cost of IVF. They have also told that well-trained, informed clinicians and IVF laboratory scientists are obligatory for the establishment and maintenance of a high-quality service (21).

Qublan HS et.al, (2005) conducted a retrospective study on the in-vitro fertilization treatment and the factors affecting its results and outcome. 765 infertile women who underwent IVF (64.6%) and ICSI (35.4%) were recruited in this study. They have found a 73.9% fertilization rate, 15.1% of implantation rate, and 29.8% positive pregnancy. Pregnant women had a multiple pregnancy rate of 28.9%, an abortion rate of 13.6%, and an ectopic pregnancy rate of 1.3%. They have concluded that the duration of treatment and type of infertility had no association with the pregnancy rate. The age of the woman, basal concentrations of FSH, adequate ovarian responsiveness, and the number of eggs collected are significant factors associated with pregnancy. They have concluded that recognizing these factors can predict the results and lead to the development of new tactics to improve the outcome of IVF treatment (22)

Gregoire Mercier and Gerald Naro evaluated the consistency of bottom-up and top-down unit costs of surgical procedures in a French tertiary center. The study took into account all hospital costs from the operating room to the post-anesthesia care unit for all consecutive inpatient surgical procedures carried out in 2010. Both top-down and bottom-up estimation techniques were used to determine unit costs. It was decided to use the ABC methodology, which involved mapping activities, figuring out activity costs, and figuring out unit costs. 4,962,900 euros were spent on 4,130 surgical procedures, with the bulk going to non-medical employees, then medical staff, supplies, and overhead. [23]

ART permits individuals and couples to attain pregnancy with infertility, a history of gonadotoxic therapies, or those with dangerous genetic conditions. Centre for Disease Control in 2017 has stated that approximately 1.9% of infants born in the US are born with the help of ART. In recent years, infertility is

tremendously increasing and so the insurance coverage of ART increases the number of couples who will seek ART will increase. [24]

Hence our study aimed to study of the cost of IVF procedure at Assisted Reproductive Technique Centre. The objectives of this study were to ascertain the cost per IVF procedure with the objective to explore the avenues for optimizing the utilization of resources and cost containment.

METHODOLOGY

This descriptive study is conducted in a total of 70 IVF procedures which took place for a period of 12 months from the month of January 2022 to December 2022 conducted in the IVF center of the Yenepoya Medical College Hospital, Deralakatte, Mangalore. The data were collected from the records maintained in the ART centre, Medical Records Department, Accounts department, pharmacy department, Purchase and stores department. A Retrospective method shall be followed to know the direct and indirect costs to conduct an IVF procedure in the Artificial Reproductive Technology Center. The staffing and infrastructure of the ART center of a tertiary care hospital will be assessed using an observational checklist. The data collected above were analyzed in consonance with available literature and published guidelines. The analysis was done using the concept of the unit costing method.

RESULTS

Cost of staff salaries in performing the procedure at ART Centre

S.no	Staff	Average monthly gross salary in Rupees	Yearly salary	Total salary
1	Gynaecologist (ART specialist)	1,15,000	1,15,000x12	13,80,000
2	Senior embryologist	45,000	45,000x12	5,40,000
3	Junior embryologist	30,000	30,000x12	3,60,000
4	Anaesthetist	1,15,000	8hx6dx52w=192 hrs 1,15,000/192= 599rs 2hrx2dayx52wkx599	1,24,592
5	Junior resident	50,000	50,000x12	6,00,000
6	Counsellor	45,000	45000/192=234 3hrx2dx52wkx234	73,008
7	Nursing staff	45,000	45,000x12	5,40,000

	(senior)			
8	Nursing staff	30,000	30,000x12	3,60,000
9	Clerical staff	20,000	20,000x12	2,40,000
10	Housekeeping staff	12,000	12000/192= 68 1.5hrx6daysx52wksx68	31,824
11	OT technician	15,000	15,000/192=78 2hrx2dayx52wkx78	16,224
			Total	Rs 42,65,650

A total amount of Rs 42, 05,650 was paid towards the staff salaries for one year. ART specialist salaries were the major part of pay among the staff. The same staffs are deputed to carry out administrative tasks of the center, hence separate administration cost consideration has not been considered in this study. The total cost of equipment used for the ART procedure is Rs 37,01,082 In the study year, the depreciation cost per annum for the equipment used for the ART procedure worked out as Rs 3,28,134.4. The total cost of the furniture used for ART procedures is Rs. 1,09,056 63 In the study year the depreciation cost per annum for the furniture used for ART procedures worked out was Rs 24,998.7.

The total cost of linen used for ART procedure is Rs 40,780 and in the study year depreciation cost per annum for the equipment used for ART procedures worked out as Rs32,263.3 The total cost of electrical appliances used for ART procedure is Rs 2,02,390 and in the study year the depreciation cost per annum for the appliances used at ART procedures worked out was Rs 43,946.19. The total cost of equipment used for the ART procedure is Rs 4,29,342.59. The total expenditure on specific hormonal drugs used for ART procedures in one year amounted to Rs 9,44,634. The total expenditure on other drugs used for ART procedures in one year amounted to Rs 95,654.41

The total expenditure on these disposables and other consumables for one year amounted to Rs 23146.04 71. The total cost of medical store items used for ART procedure during the study worked out to be as 10,63,434.45 The total cost of a unit IVF procedure worked out by this study is Rs 1,00,771.39. The main cost drivers identified were staff salaries (59.62%) cost of medicines and consumables (26.62%) and cost of equipment and total maintenance expenses (12.23%)

DISCUSSION

Infertility is a global issue that affects individuals from various socioeconomic backgrounds, regardless of their location or social status. Each year, an estimated 60 to 80 million couples experience infertility, with a significant number of around 15 to 20 million residing in India alone. Since many cases of infertility can be prevented, it is crucial to address this issue promptly. The cost of treating infertility is significant, with estimates ranging from 1,00,000 to 2,50,000 per cycle with a successful outcome of a live birth. These high costs can be

attributed to the expensive infrastructure required, the medications needed to stimulate multiple ovulations and maintenance expenses.

Currently, most ART centers are privately operated, limiting the benefits of these medical advancements to wealthier individuals. While there are some government-funded hospitals in India that provide IVF treatment either free of charge or at reduced costs, these facilities often face challenges due to overcrowding and insufficient funding, leading to difficulties in updating and improving their services. This situation is concerning, particularly considering the increasing number of infertile couples, as it hampers the development of the country.

Conducting cost analysis research helps understand the true costs incurred by hospitals in providing medical services. This analysis enables the effective and efficient operation of the healthcare organization. Additionally, by examining the hospital's infrastructure and staffing structure, it becomes possible to determine whether the facilities meet the necessary standards for providing patients with the best possible treatment and care.

The study primarily examined two aspects of the ART center: the physical facilities available and the staffing pattern within the IVF center. These observations aimed to provide insights into the infrastructure and human resources supporting the IVF procedures.

Additionally, the study aimed to identify the main cost centers associated with the cost of a single IVF procedure. To achieve this, the researchers conducted a detailed analysis of various activities involved in the IVF process. This included examining the costs associated with each activity. By summing up these costs, the total cost of one IVF procedure could be calculated.

Overall, this research delved into the physical aspects, staffing patterns, and cost analysis of IVF procedures, with the objective of gaining a comprehensive understanding of the IVF center's operations and expenses.

Past researchers calculated the mean direct and indirect medical costs associated with one cycle of IUI and IVF. The average direct cost for one cycle of IUI was found to be 19,561,140 Iranian Rials (IRR), while the average direct cost for one cycle of IVF was 60,897,610 IRR. These costs encompassed the expenses directly related to the procedures, such as medical consultations, tests, medications, and laboratory services. Additionally, the study also considered indirect costs, which include factors like transportation and lost productivity (22, 23).

Furthermore, the study aimed to determine the willingness to pay (WTP) of individuals in the community for IUI and IVF treatments. The researchers found that the mean WTP for one cycle of IUI was 15,941,061 IRR, while the mean WTP for one cycle of IVF was 28,870,833 IRR. This value represents the amount individuals were willing to pay out of their own pocket for these treatments.

The findings of this present study provide insights into the economic aspects of IUI and IVF treatments in Iran (19). By assessing the costs and community preferences, the researchers aimed to evaluate the affordability of these services for individuals seeking fertility treatments. This information can be valuable for policymakers, healthcare providers, and patients in understanding the financial implications and accessibility of assisted reproductive technologies. In terms of fertilization costs, which encompass laboratory procedures involved in IVF, they constituted 12% of the total costs for IVF and 20% for ICSI. This suggests that the expenses related to fertilization techniques were a significant contributor to the overall cost of both procedures. Overall, the study concluded that the total cost per cycle of ICSI was 8.3% higher than that of IVF. This disparity can be attributed to various factors, including the higher costs of medications and the additional laboratory processes involved in ICSI (20). This study also highlights the various components that contribute to the cost of an IVF procedure. The major component is staff salary, accounting for 59.62% of the total cost. As staff salaries are subject to periodic increases due to factors like dearness allowances, grade increments, and promotions, this cost is expected to rise over time. The second significant expenditure is medical store drugs, consumables, and investigations, which constitute 26.60% of the total cost. This component presents an opportunity for cost containment measures to be implemented by the administration. The third major component is equipment cost and its maintenance, which remains a fixed cost every year. The combined expenses of medical store items and equipment make up 33% of the unit cost, while maintenance costs add an additional 5-8% each year. Thus, the total cost of a unit IVF procedure is calculated to be Rs 1,00,771.39.

CONCLUSION

The tertiary care hospital recognizes the significance of cost accounting and cost consciousness in its role as a teaching hospital. To address this, a study was conducted to determine the cost of the In Vitro Fertilization (IVF) procedure and provide recommendations for resource optimization. The study found that the total cost per IVF procedure was Rs. 1,00,743, with staff salaries accounting for 59.62% of the cost. Comparing the cost per procedure to the national average, it falls within the range. However, the study revealed that the fee for the natural stimulant 1st cycle was significantly lower than the hospital's cost per procedure. To make IVF more accessible to lower socioeconomic groups, it is recommended to increase the number of procedures rather than raising the cost. This study emphasizes the importance of cost accounting and offers insights into effective cost management and resource allocation in IVF procedures.

AUTHOR'S CONTRIBUTION

Anjali C S carried out the conception and design of this study, acquired the data, analysis part and drafted the article with intellectual content. Sunitha Saldanha interpreted and gave the final approval for publishing in the journal.

CONFLICT OF INTEREST

The author declared “no conflict of interest”

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