Robotic Surgery: Awareness by ASHA Workers among Rural Women in PCOS

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ABSTRACT

The study is a project to look at the awareness of PCOS among rural women and to compare awareness with and without the intervention of ASHA workers in rural women via robotic surgery. The study is a descriptive type and is confined to the geographical boundaries of the rural districts located in the southern states of the country, viz., Karnataka, Andhra Pradesh, Telangana, Tamil Nadu and Kerala with a structured questionnaire, which was administered through Accredited Social Health Activist (ASHA) to gather the primary data from the rural women. The cluster sampling technique was used to get a total sample size of 600 participants. One commonly used statistical tool during the study is SPSS (Statistical Package for the Social Sciences) to test the hypothesis using a variety of tests, including the Paired T-test, Analysis of Variance, Exploratory Factor Analysis (EFA), and Pearson Correlation. The findings of the study indicated that there is a significant difference in the level of knowledge of the rural women about the PCOS disorder, more specifically in robotic surgery as a practical solution, based on core knowledge determinants, which include Symptoms, Causes, and Risks between ASHA workers for awareness of the medical disorder.

Keywords: Gynecologic Robotic Surgery; Awareness; Polycystic Ovarian Syndrome; Rural Health; ASHA Workers; Symptom; Risk; Hormones; Innovation; Emerging Country.

1. Introduction

Robotic Surgery is one of the most complex and emerging scientific processes in medical surgeries, which are performed with the help of robotic systems. The idea behind innovating this mechanism was to overcome the limitations of pre-existing minimally-invasive surgical procedures and to improve the capabilities of surgeons while performing open surgeries in the hospitals. These surgeries are robotically-assisted offering a greater range of motion and precision leading to less bleeding and post-operative pain among the patients. It also enables in allowing the surgeons to perform any type of complex procedures through tiny incisions. This type of medical surgery has been successful in many western nations due to advancement in technology, availability of quality surgeons and financial resources encouraging most of the patients to opt for this surgery. However, the situation is not the same among the developing and under-developed, especially the Asian countries due to scarcity of financial resources and availability of skilled surgeons to perform the procedures. Most of the women in India are affected by polycystic ovarian syndrome (PCOS) conduction especially among the youngsters and middle-aged women. This has a serious health impact if non-monitored in time (Holloway et al., 2009).

PCOS is a hormonal disorder causing enlarged ovaries with small cysts on the outer edges in the female reproductive organ. Women often are exposed to irregular or prolonged menstrual cycle affecting their health to a greater level. This can be due to high level of male hormones preventing ovaries from producing and releasing regular eggs as the numerous small collections of fluid (follicles) block the process. There are four types of PCOS namely Insulin-resistant PCOS, Inflammatory PCOS, Hidden-cause PCOS, and Pill-induced PCOS. Many a times, smoking, excess sugar intake, pollution and Tran's fat result in this disease among the young girls. Some of the common symptoms experienced by women with this disorder including weight gain, acne, irregular periods, hair loss, unwanted body hair growth and difficulty in falling pregnant (Advincula & Song).

There are four major types of PCOS found in women like Insulin resistant, Pill induced, Inflammatory, and Adrenal. Higher levels of circulating insulin increase the production of androgens in women that intervenes with ovulation and leads to other symptoms. Some of the oral contraceptives contain high androgen leads to temporary hormonal imbalance which result as pill induces type. High-level inflammation stemming from an overactive immune system can stimulate the ovaries to produce androgen hormones leading to irregular menstruation cycle. Intense stress, body reacting abnormally which forces adrenal glands to produce high androgen leads to Adrenal type of PCOS (Lauterbach et al., 2017).

There are numerous surgical methods that facilitate in treating the PCOS like Laparoscopic, Cyst aspiration and Unilateral Oophorectomy. Laparoscopic ovarian drilling is a surgical treatment that triggers in ovulation among the women suffering with PCOS through a laser destroying some parts of the ovaries. Small incision in the abdomen is made while performing surgery without damaging the internal organs. A needle in inserted through the vaginal wall and evacuates the contents of the cyst through the mechanism of cyst aspiration relieving the discomfort and improves fertility. Unilateral Oophorectomy is another surgical treatment for ovulation induction in patients which is no longer accepted in current scenario (Fritz & Speroff, 2011).

There are minimal research contributions to the literature related to robotic surgery, PCOS and gynaecology among the rural women which has led the researcher to identify the research gap to explore the current study with the research questions framed to conduct the study comprises of "Are the rural women in southern states of India, aware of PCOS?", "Can Gynaecologic Robotic Surgery be a feasible option to address the gynaecology issues among the rural women?"

Gynaecologic Robotic Surgery is one of the latest innovations in minimally invasive surgical techniques enabling the surgeon to operate using light scope and miniature instruments controlled through a robotic system especially while treating reproductive organs of a woman. However, the surgery seems to be successive only when the patients are aware of their symptoms of various problems related to their reproductive organ and efforts taken to address the same in a timely manner. Therefore, the study revolves around the awareness of the PCOS among the rural women in the southern parts of India and challenges encountered during these procedures through robotic surgery.

The practical implications of this study will encourage government to take measures to educate and create awareness programs about various diseases, problems related to reproductive organs of women. It will also help the surgeons to take the patients into confidence with minimal pain and faster recovery rates. It enables the government to take suitable measures to adapt this type of surgery at affordable price to the rural patients.

The study was conducted especially during the COVID-19 as the ASHA workers were easily accessible to help in collecting the primary data and considering the health issues of these rural women being one of the important factors for healthier living as they limited access and awareness to sophisticated health solutions.

1.1. Study Objectives

The study is focused on the below objectives that were intended to be answered:

1) To examine the awareness of the respondents with respect to PCOD or PCOS.

2) To compare the awareness among the respondents before and after invention of ASHA workers.

3) To understand if robotic surgery can be an effective to treat the PCOD/PCOS issues among the young women in rural population?

4) To explore the factors influencing the health of rural women.

5) To compare the impact of treatment between traditional and robotic surgery to treat the disease.

The research is aimed at examining the awareness of PCOS among the rural women and to assess the difference in awareness when ASHA workers intervene among the rural women.

2. Theoretical Framework & Hypothesis Development

Robotic surgery is still in its infancy stage and with the advancement in the technology, it seems to very promising. It has been proven that this technology is affordable and convenient with improved efficacy with ability to scale motions, elimination of fulcrum effect (Lanfranco et al., 2004). Selective digestive procedures seem to be beneficial from robotic surgery as its market is growing with the effects of miniaturized surgical procedures relieving patients from the pain. Image guidance through the concepts of augmented reality, it increases the safety in reducing the surgical complications (Diana & Marescaux, 2015).

A surgical robot assistant was applied to perform a surgery under the supervision of a surgeon which was mechanically controlled and assisted through image system in transurethral resection of the prostate, resulted to be successful (Ng et al., 1993). The advancement in the technology has eased the cardiac surgery being performed very smoothly with better results and minimal pain to the patients. These surgeries are categorized into low or high-volume procedures due to their opportunity in the market (Mack, 2001). The surgery is though very safe and promising, it is relatively expensive for the patients to afford especially in gynaecology procedures related to tubal reanastomosis, myomectomy, etc., which can offer extremely good results among the patients (Schreuder et al., 2008).

The post-surgery proves to be promising due to the merits of Less scarring, faster recovery time, tiny incisions, Zero transfusion rate, shorter catheter time 1-5 days v/s 14-20 days, significantly shorter return to normal activities (1-3 weeks), Equal Cancer Cure Rate, less post-operative pain. This technique reduces the conventional invasive method of surgeries, giving an edge to the surgeons (Ballantyne, 2002). Although robotic surgery is still in its infancy, it is a cutting-edge development in surgery that will have far-reaching outcomes. Telerobotic surgery emphasis on delivering surgical care to patients who have no direct access to a surgeon; however, costs are prohibitive to the spread of such technology to underserved areas that need it most (Morris, 2005).

Innovative technological changes comprising virtual reality, haptics, tele monitoring can prove to be a new medium for acquisition and assessment of surgical skills through simulation of all operations that can be done through the robot as it calls for specialized training. The surgeons try to put forward the developmental stage of robot-assisted surgery, especially newly advance technology, i.e. da Vinci system. The da Vinci robotic surgical

system givens approval for the use in gynecologic surgery in the U.S. in 2005 (Saraf, 2006). Thus, the first hypothesis s developed as below:

H_0^1: *Rural women are not aware of the factors leading to PCOS.*

Robotics and telerobotics offer prospective solutions to address the medical complications when compared to laparoscopic surgery when disease is detected at its early stage of development (Ballantyne, 2002). The voice-activated robotic arm performs the operation through the vision obtained from the camera panel in which it seems to be very effective as the time spent was less with improved efficiency allowing the surgeon to use both the hands (Herron & Marohn, 2008). This provides high quality visual and dexterity to the surgeons to address gynaecological diseases where patients are often shy and sceptical about the procedures due to its cost and efficiency. However, the surgery has proven fruitful in various pelvic-abdominal diseases (Hanly & Talamini, 2004).

Robotic world of precision and accuracy is spoken of and implemented in many areas; it still comes with varied limitations. In developing countries, robots replacing humans gets treated as science fiction. There is always a quest for advancement. Hence, robotic dentistry is a fiction that could be a reality in a matter of time. Use of robotics in dentistry is exploring with all the necessary technologies which could further be developed and could be easily adapted (Singh et al., 2016).

H_0^2: *There is no positive role of ASHA workers in creating awareness among the rural women about PCOS.*

Surgical guides and creating digital impressions of preparations using an intraoral scanner, after which a milling device produces the restoration. Despite Minimally Invasive Surgery being expected to reduce surgical complications, Robotic-assisted laparoscopic procedures present several specific hazards. Well-selected patients, adequate positioning, mentorship training during the learning curve to avoid last-longing procedures are key steps to prevent RAL-related complications. Fortunately, those specific complications are rare, but one should keep alert as they can be devastating if not recognized early, thus surgeons should have a low edge of doubt (Bhat et al., 2017). A dedicated robotic team is essential to reduce complications. Patient's selection, surgical positioning, mentorship training, and avoiding long-lasting procedures are essential to prevent RAL-related complications (Nolan et al., 2018). Thus, the second hypothesis framed as,

H_0^3: *There is no positive relationship between ASHA workers and awareness in robotic surgery.*

3. Methodology and Instrument

The research study is exploratory in nature and restricted to the geographical boundaries of the rural districts of the southern states namely Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, and Kerala. A structured questionnaire was administered through Accredited Social Health Activist (ASHA) to collect the primary information from the respondents, rural women. These workers are closely associated with women as they act as health activist in the community who create awareness on health and its social determinants. Cluster Sampling method was adopted to arrive at a sample size of 600 respondents who were categorized based on their marital

status and further considered their age groups leading to recognition of teenagers, young adults and middle-aged women.

The research instrument is grouped into two major categories, first component includes demographic profile of the respondents, and second component of the instrument includes construct statements based on a five-point Likert scale related to symptoms, causes, risks and traditional surgery methods. Each unit is the woman respondent considered in the study.

The variables related to construct statements were based on the previous research contributed to the literature that were apt for the current study The demographic variables considered for the study involves age, and marital status which are measured as nominal. The variables of the construct symptom consist of abnormality, ovaries, and androgen. Construct "causes" are derived based on the variables namely heredity, insulin, and inflammation are measured as scale. The variable of the construct risks involves diabetes, infertility, and cardiac issues. Traditional surgery variables include painful, stay and expensive are measured as scale.

A Statistical Software tool used during the study is SPSS (Statistical Package for Social Sciences) to validate the hypothesis applying various tests including Paired T-test, Analysis of Variance, Exploratory Factor Analysis (EFA) and Multiple Linear Regression Analysis.

4. Results

4.1. Reliability and Validity Analysis

Reliability analysis was performed on the variables comprising of 15 items. The Cronbach's alpha reflected ($\alpha = 0.879 > 0.70$, N = 600) for the questionnaire with good reliability (Keith, 2018). All the items appeared to be worthy of retention, confirming the high reliability of the items. Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's test reveals (KMO = $0.800 > 0.70$, $\chi2 = 1640.02$, $p < 0.001$) the sample adequacy confirms the validity (Kaiser & Rice, 1974).

4.2. Simple Percentage Analysis

A simple percentage analysis was conducted to examine the demographic profile of the respondents. There were 143 respondents with 23.8 per cent of the age group between "15-20 yrs", 143 respondents with 24.3 per cent of the age group between "21-25 yrs", 166 respondents of the age group between "26 -30 yrs" with 27.7 per cent and 24.2 per cent of the respondents (145) belong to the age group between "31-35 yrs".

300 respondents of the total sample size constituting 50 per cent reflected to be "single" and rest of the 300 respondents were falling into the bracket of "Married" status contributing 50 per cent to the sample size.

250 respondents were either aware or had undergone the traditional surgeries to find solutions to their medical disorders among the total respondents considered for the study.

4.3. Exploratory Factor Analysis

The reliability test was conducted to examine the correlation between the scale items was above 0.30 (Field, 2005). The final set of scale statements included twelve items whose overall reliability ($\alpha = 0.825 > 0.70$, Nunnally, 1978)

confirming the suitability for further analysis. All item correlations between those twelve statements were above 0.30, substantial for factor analysis (Hair et al., 1995) as discussed in Table 1.

Table 1. KMO and Bartlett's Test

Test Statistic		Sig.
Kaiser-Meyer-Olkin Measure	Bartlett's Test Sphericity Chi-Square	0.000**
0.729	26.166	
Source: Primary Data. **Significant @ 1 per cent.		

The overall significance of the correlation matrix was assessed with Bartlett test of Sphericity, which provides the statistical probability that the correlation matrix has significant correlations among at least some of the variables. The results were significant at $p < 0.01$, ($\chi2 = 26.166$, $N = 600$), which further confirmed that the data were suitable for factor analysis. Lastly, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was computed to quantify the degree of inter correlations among the variables, and the results indicate an index of 0.81, an "Excellent" indicator of adequacy for factor analysis (Kaiser, 1970). This confirms the strong relationship between the variables being statistically significant. Hence Factor analysis is considered as an appropriate technique for further analysis of the data.

Exploratory Factor Analysis was performed to examine the pivotal factors influencing the awareness among the rural women regarding the PCOS disorder using the Principal component analysis extraction method and Varimax rotation to arrive at the key factors as depicted in Table 2.

Table 2. Principal Component Analysis

Variables	Factors			Extraction
	1	2	3	
Infertility- S1		0.862		0.758
Androgen - S2	0.830			0.702
Heredity - S3	0.758			0.624
Abnormality- S4			0.538	0.644
Ovaries- S5			0.899	0.834
Diabetes- S6		0.772		0.668
Eigen value	1.924	1.205	1.101	
Per cent of variance	32.065	20.079	18.352	
Cumulative per cent	32.065	52.144	70.496	
Source: Computed from primary data.				

Exploratory Factor analysis resulted with three key factors which influence the awareness of PCOS disorder among the rural women. Varimax rotation method was used to arrive at the factor loadings of the variables within

the respective group of factors through 5 iterations while the loadings were rotated explaining the variance of awareness among the rural women by 70.496 per cent.

The extraction communalities of variables infertility (0.758), Androgen (0.702), heredity (0.624), abnormality (0.644), ovaries (0.834), and diabetes (0.668) in the extracted factors were above 0.50 considering worth interpreting the influencing factors representing the amount of variance accounted by the factor solution for each variable (Hair, et.al, 1995, p.387). The factor loadings of each variable is greater than 0.50 (Hair, et.al, 1995) and all factors whose Eigen values was greater than 1.0 (Tabachnick and Fidell, 1989). Hence the null hypothesis can be rejected and alternative accepted. Therefore, the results prove that there is significant awareness among the rural women about the disorder based on *Factor 1: Causes, Factor 2: Risks and Factor 3: Symptoms.*

The first factor describes the variables clustered as Causes of the disorder involving androgen (0.830), heredity (0.758) explaining the variance by 32.06 per cent in the awareness (Eigen value = 1.924). The second factor illustrates the variables clustered as Risks involved due to the disorder consisting of the variables like infertility (0.862), and diabetes (0.772) explaining the variance in the awareness among the respondents by 20.07 per cent (Eigen value = 1.205). The third factor briefs the variables clustered as Symptoms hinting the disorder and its severe impact on the health comprising of the variables like abnormality (0.830), and heredity (0.758) explaining the variance in the awareness among the respondents by 18.352 (Eigen value = 1.101).

4.4. Paired Sample T-Test

Paired Sample t-test was performed to examine the relationship between awareness and ASHA workers as explained in Table 3.

Table 3. Comparison in Awareness among the rural women

Awareness Factors	Before ASHA Workers		After ASHA Workers		Values	
	M	SD	M	SD	t	Sig.
Symptoms	6.532	2.227	8.820	3.273	65.999	.000**
Causes	6.633	2.913	8.922	3.197	68.362	.000**
Risks	6.350	3.079	8.638	3.365	62.882	.000**
** Significant at 1 per cent level.						

The comparison in the awareness levels of the rural women regards to PCOS disorder before and after intervention of ASHA workers in educating them about the factors leading to the disorder and the probable solution in terms of robotic surgery. The results are statistically significant at 1 per cent level, and hence the null hypothesis is rejected. There is significant difference in awareness in terms of symptoms, causes and risks involved with the disorder among the rural women before and after the intervention of ASHA workers. The results indicated that the mean score of among the women related to symptoms of the disorder leading to PCOS after the intervention of ASHA workers (M = 8.820, σ = 3.273) was significantly higher than before their interventions (M = 6.532, σ = 2.227). The results indicated that the mean score of among the women related to causes of the disorder leading to PCOS after the intervention of ASHA workers (M = 8.922, σ = 3.197) was significantly higher than before their

interventions (M = 6.633, σ = 2.913). The results indicated that the mean score of among the women related to risks of the disorder leading to PCOS after the intervention of ASHA workers (M = 8.638, σ = 3.365) was significantly higher than before their interventions (M = 6.350, σ = 3.079).

4.5. Analysis of Variance

ANOVA was applied as an extension of paired sample t-test to examine the difference in the mean within the awareness in PCOS disorder based on the symptoms, causes and risks among the rural women. Table 4 describes the results of the same. In order to test the hypothesis that the intervention of ASHA workers had no effect on the awareness among the rural women on PCOS, a between – groups ANOVA was performed. Prior to conducting the ANOVA, the assumptions of normality were evaluated and determined to be satisfied as the groups' distributions were associated with skew and kurtosis less than $|2.0|$ and $|9.0|$, respectively (Schmider et al., 2010). Furthermore, the assumption of homogeneity of variances was tested and found satisfied based on Levene's *F* test for the awareness factors, symptoms (F = 2.266, p = .133), Causes (F = 0.163, p = .687) and Risks (F = 1.523, p = .218) as reflected in Table 4.

Table 4. Goodness-of-Fit Indices on Awareness after ASHA workers

Awareness Factors	Test of Homogeneity of Variances		Robust Test of Equality of Means		ANOVA	
	Levene Statistic	Sig.	Welch Statistic	Sig.	F Statistic	Sig.
Symptoms	2.266	.133	2.491	.120	2.840	.002**
Causes	0.163	.687	6.116	.140	6.137	.014*
Risks	1.523	.218	2.709	.106	2.997	.000**
**Significant at 1 per cent, * Significant at 5 per cent level.						

The independent between-groups ANOVA yielded a statistically significant effect of awareness in symptoms (F = 2.840, p < 0.001), Causes (F = 6.137, p < 0.05), and Risks (F = 2.997, p < 0.001) confirming that there was significant positive effect when intervened by ASHA workers among the rural women on PCOS disorder. The robust test of equality of means was also satisfied confirming considering the Welch Statistic (Tomarken & Serlin, 1986) among the awareness factors of Symptoms (F = 2.491, p > 0.05), Causes (F = 6.116, p > 0.05), and Risks (F = 2.709, p > 0.05). Hence, the null hypothesis was rejected and alternative accepted.

4.6. Pearson Correlation Analysis

A Pearson Correlation examined the relationship between Awareness, Traditional Surgery and Robotic Surgery with intervention of ASHA workers explained below in Table 5.

Table 5. Relationship between Awareness, Traditional & Robotic Surgery

Intervention	Awareness	Traditional	Robotic
Awareness	1	-	-
Traditional	0.472	1	-
Robotic	0.861**	-0.240	1
Source: Computed from primary data. ** Significant @ 1 per cent level.			

A correlation of awareness and robotic surgery was found to be highly positive and statistically significant ($r = 0.861$, $p < .001$). There was low correlation between traditional surgery and awareness among the rural women ($r = 0.472$, $p > .05$). However, there was a negative correlation between the traditional and robotic surgery ($r = -0.24$, $p > .05$). Hence, the alternative hypothesis is supported by obtained correlation coefficient values (Mukaka, 2012), rejecting the null hypothesis. Therefore, there is positive and high impact on awareness among the rural women regarding robotic surgery when intervened by the ASHA workers when compared to traditional surgery.

5. Findings & Discussions

The findings of the current research study led to explore the major symptoms includes abnormality in menstrual cycle, the ovaries get enlarged leading them to fail to function appropriately and increased levels of androgens results in physical appearances like excess body and facial hair with severe acnes. Heredity is one of the reasons behind PCOS as genes play a spoilsport with a link to the mentioned disorder. Excess intake of insulin and women suffering from this disorder tend to develop low-grade inflammation that increases the production of androgen causing difficulties on ovulation.

These symptoms causes' severe risks among these women like development of type 2 diabetes, increases infertility rates with metabolic syndrome. Also, the results reflect that women are aware of the traditional surgeries to address this medical disorder which is more painful with heavy blood loss, and longer stay in the hospitals until the patients recover. However, the cost associated with the traditional surgery is less expensive when compared to the robotic surgery.

The experiences shared by the ASHA workers during the research study also revealed that most of the rural women being educated at least in their native language did understand the symptoms, causes and risks leading to this disorder. These workers succeeded in creating awareness among the rural women towards the PCOS disorder through symptoms, causes and risks with probable solution in robotic surgery when compared to traditional surgery.

6. Conclusion

Technology has improved rapidly and therefore there is no such major risk involved in robotic surgery as the surgeon's possesses formal training with robotic system in different area of specialization. The results from the study revealed that there is a significant difference in the awareness level among the rural women towards the PCOS disorder especially in robotic surgery as a probable solution based on key awareness factors comprising Symptoms, Causes and Risks. There is positive & high correlation between the ASHA workers and awareness among the respondents in the medical disorder. Therefore, the study led to the answers based on the research questions that the rural women in southern states of India are well aware of the PCOS disorder. Also, through effective guidance and measures from the government, Gynaecologic Robotic Surgery be a feasible option to address the gynaecology issues among the rural women.

Early diagnosis of PCOS is important as it has been linked to an increased risk for developing several medical conditions including insulin resistance, type 2 diabetes, high cholesterol, high blood pressure and heart disease.

PCOS is an emerging health problem during adolescence therefore promotion of healthy lifestyles and early interventions are required to prevent future morbidities.

6.1. Future scope of research

The researchers of the interest may consider the following the areas to explore further (Lanfranco et al., 2004):

(a) Health quality index can be used to understand the quality of health among the rural women.

(b) Accessing to health care support like prenatal, delivery and postnatal nursing in rural setting.

(c) The mental and emotional wellbeing of these women can be studied to understand their anxiety, stress levels.

(d) Impact of social and gender bias or violence can be studied.

(e) Environmental and occupational health in terms of water scarcity, early marriage, indoor air pollution may be considered.

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