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Evaluation of Breast Lumps in Females Below 40 Years: A Prospective Cohort Study from a Rural and Semi-Urban Population

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Abstract

BACKGROUND

To evaluate the clinical presentation, diagnostic patterns, treatment outcomes, and follow up of breast lumps in women aged 18–40 years, and to assess differences between rural and semi-urban populations.

METHODS

This prospective observational cohort study included 108 women aged 18–40 years with previously undiagnosed breast lumps. Participants underwent standardized clinical evaluation, imaging, and tissue diagnosis as indicated. Management strategies included surgery, medical therapy, or observation with follow up. Statistical analysis was performed using descriptive statistics and Chi-square test.

RESULTS

Ultrasonography was the most frequently used imaging modality (69.4%). Histopathology revealed benign lesions in 64.8%, malignant lesions in 27.8%, and atypical hyperplasia in 7.4%. Surgical intervention demonstrated the highest complete response rate (87.5%) with low complication (6.5%) and recurrence (2.8%) rates. Rural participants showed lower education and access to healthcare compared with semi-urban participants.

CONCLUSIONS

A structured diagnostic and management approach resulted in favorable outcomes in young women with breast lumps. Socio-demographic differences influenced presentation patterns but did not adversely affect treatment effectiveness.

TRIAL REGISTRATION:

Not applicable.

INTRODUCTION

Breast disease remains the most prevalent cancer among women worldwide, contributing to significant morbidity, psychological distress, and mortality. Although the disease primarily affects older women, it can also manifest in younger populations.[1] Breast cancer occurs in approximately 6.6% of cases in

women below 40 years, in 2.4% of cases in those under 35 years, and as low as 0.65% in those under 30 years of age.[2]

Breast lumps in women under 40 years are common and pose diagnostic challenges due to dense breast tissue, a wide spectrum of benign conditions, and lower cancer prevalence, necessitating careful clinical and imaging evaluation.[3] The burden of breast lumps in young women is substantial, with a high prevalence of benign conditions causing anxiety, repeated clinical visits, diagnostic uncertainty, and increased healthcare utilization. Notably, the prevalence of anxiety and depressive symptoms among patients with benign breast lumps was 40.2% and 62.0%, respectively, highlighting the significant psychological impact even in non-malignant disease.[4]

Globally, there is a growing focus on addressing breast cancer through early detection and prevention programs, which can reduce the disease burden and improve outcomes. International health organizations are actively promoting breast cancer awareness and advocating for more accessible screening and treatment options worldwide. Some initiatives focus on educating women about self examinations, while others work to improve healthcare infrastructure for screening in underserved areas.

In the last two decades, numerous prospective and retrospective studies have consistently demonstrated that younger age at diagnosis is associated with poorer clinical outcomes. This phenomenon is observed regardless of menopausal status, reinforcing that age remains a relevant risk factor even in younger women. Specifically, survival for women under 40 years of age is worse than that of older women, irrespective of histological subtype or stage at diagnosis.[5]

In rural and semi-urban settings, early evaluation and management of breast lumps are often challenged by limited awareness, socio-economic constraints, delayed health seeking behavior, and restricted access to specialized diagnostic services. These factors contribute to delays in presentation and highlight the importance of structured assessment strategies tailored to younger women in non-urban populations.

Available evidence from rural regions remains limited and inconsistently reported compared with urban settings, resulting in gaps in understanding disease presentation and outcomes in these populations. To address this limitation, the present prospective cohort study was designed to evaluate the clinical presentation, diagnostic pathways, and treatment outcomes of breast lumps in females aged 18–40 years from rural and semi-urban populations. The study further aimed to monitor symptom progression, examine the utilization of diagnostic modalities, and assess therapeutic outcomes over a defined follow up period.

This study represents one of the few prospective cohort analyses focusing exclusively on young women from rural and semi-urban regions in low and middle income settings. There is limited published literature describing the diagnostic pathways and outcomes of breast lumps in this population. The findings provide region specific epidemiological data that are relevant to developing early detection strategies and screening policies in similar healthcare settings internationally.

MATERIAL AND METHODOLOGY

This longitudinal cohort study was conducted in teaching hospitals affiliated with the Department of General Surgery and included women aged 18-40 years presenting with breast lumps. After obtaining informed consent, participants underwent detailed history taking and physical examination, with documentation of clinical presentation, diagnostic procedures, treatment modalities, outcomes, and relevant risk factors during follow-up.

PARTICIPANT SELECTION CRITERIA:

Inclusion Criteria:

Participants eligible for inclusion in the study were females aged between 18 and 40 years who presented with undiagnosed breast lumps and had not undergone any previous medical intervention or surgical treatment related to the condition. (Only female participants were included, as the study focused on evaluation and management of breast lumps in women) Only those who voluntarily provided informed consent were enrolled. Additionally, individuals with a positive family history of breast cancer or breast lumps were considered eligible.

Exclusion Criteria:

Females over the age of 40 years were excluded from the study, as were individuals who refused or were unable to provide informed consent. Also excluded were those with previously diagnosed breast lumps, patients currently receiving treatment for the condition, and individuals with a history of surgery for breast lumps or other related breast lesions.

STUDY DURATION:

The study commenced following the approval of the Institutional Ethics Committee (IEC) and continued until April 2025. Throughout the study period, data was collected systematically and analyzed to assess diagnostic accuracy, treatment outcomes, and duration of hospital stays. A comprehensive analysis was performed after the data collection phase concluded.

SAMPLE SIZE:

The sample size was estimated using the prevalence method for proportions at a 95% confidence level, based on an assumed prevalence of 137 per 100,000 women under 40 years, yielding a required sample size of 108 participants.

SAMPLING METHOD:

A non-probability purposive sampling method was used, enrolling eligible women with breast lumps after informed consent, with evaluation and investigations performed as indicated.

TOOLS AND DATA COLLECTION:

Data were collected through clinical evaluation, imaging, laboratory investigations, and biopsy procedures. Participants underwent detailed history taking and physical examination, followed by ultrasonography, mammography, or MRI as clinically indicated, with imaging interpreted by experienced radiologists blinded to histopathology. Histopathological confirmation was obtained using FNAC or core needle biopsy, and all specimens were assessed by qualified pathologists. Laboratory investigations included CBC, renal and liver function tests, serum electrolytes, random blood glucose, and PT/INR. Follow-up assessments were conducted at 0-6, 6-12, and 13-24 months.

All collected data were recorded systematically using structured data collection tools for further analysis.

OUTCOME DEFINITION:

Primary outcomes included diagnostic accuracy, histopathological diagnosis, and treatment response. Secondary outcomes included symptom resolution, need for surgical intervention, and complications.

Complete response was defined as complete clinical and/or radiological resolution of the breast lump with no residual lesion on follow up. Partial response was defined as a reduction in lump size or symptom severity without complete resolution. No response or progression was defined as persistence or increase in lump size or symptoms.

STATISTICAL ANALYSIS:

Data analysis was performed using SPSS version 20.0**.** Descriptive statistics (mean, range, standard deviation, and median) were used to summarize quantitative data. Categorical data were expressed as frequencies and percentages. The Chi-square (χ^2) test was used to assess the association between categorical variables. A p-value < 0.05 was considered statistically significant.

RESULTS

DEMOGRAPHIC PROFILE:

A total of 108 women aged 18–40 years were included, comprising 84 participants from rural areas and 24 from semi-urban areas. The demographic characteristics were compared between rural and semi-urban groups to identify patterns of variation. In the rural group, the most common age category was 18–24 years (27.3%), whereas in the semi-urban group, participants were more frequently aged 24–29 years (37.5%). Both groups were predominantly Hindu, although relatively greater religious diversity was observed in the semi-urban population. Housewives constituted the majority occupational group in both settings. Educational attainment differed between groups, with a higher proportion of semi-urban participants having college level education or above (50.0%) compared to rural participants (21.4%).

Marital status was comparable, although earlier age at marriage was more frequently observed among rural participants. Monthly income levels were similar across groups, with over half of participants earning less than ₹5,000 per month (Table 1).

Table 1
Demographic Characteristics

Characteristics	Rural Group n (%)	Semi-Urban Group n (%)
Total Participants	84	24
Age (in years)		
18–24	23 (27.3%)	3 (12.5%)
24–29	21 (25.0%)	9 (37.5%)
30–35	18 (21.4%)	7 (29.1%)
36–40	12 (14.2%)	5 (20.8%)
Religion		
Hindu	36 (42.8%)	12 (50.0%)
Muslim	16 (19.0%)	7 (29.1%)
Others	32 (38.0%)	5 (20.8%)
Occupation		
Housewife	44 (55.3%)	15 (62.5%)
Business/Teacher/Office Worker	40 (47.6%)	9 (37.5%)
Education Level		
Illiterate	9 (10.7%)	2 (8.3%)
Primary School	20 (23.8%)	4 (16.6%)
High School	33 (39.2%)	6 (25.0%)
College and Above	18 (21.4%)	12 (50.0%)
Marital Status		
Married	44 (52.3%)	12 (50.0%)
Unmarried	22 (26.1%)	7 (29.1%)
Divorced/Widow	18 (21.4%)	5 (20.8%)
Monthly Income (INR)		
< ₹5000	46 (54.7%)	14 (58.3%)
₹5000–₹10000	24 (28.5%)	7 (29.1%)
> ₹10000	14 (16.6%)	3 (12.5%)
Age at Marriage (years)		

Characteristics	Rural Group n (%)	Semi-Urban Group n (%)
20–24	45 (53.5%)	10 (39.2%)
25–30	25 (29.7%)	8 (33.3%)
31–35	8 (9.5%)	4 (16.6%)
36–40	6 (7.1%)	

DIAGNOSTIC TECHNIQUES:

All participants underwent clinical breast examination followed by imaging evaluation. A stepwise diagnostic approach was used, tailored to clinical findings. Ultrasonography was the most commonly utilized imaging modality, performed in 69.4% of cases, followed by mammography in 37.0% and MRI in 18.5% of participants. For tissue diagnosis, FNAC was performed in 46.3% of cases, while core needle biopsy was used in 27.8%. Histopathological evaluation revealed benign lesions in 64.8% of participants, malignant lesions in 27.8%, and atypical hyperplasia in 7.4%. The combined use of imaging and tissue. diagnosis allowed effective characterization of breast lumps (Fig. 1).

TREATMENT OUTCOMES:

Management strategies included surgical intervention, medical treatment, or observation with structured follow up. Surgical intervention was performed in 37.0% of cases, medical management in 18.5%, and follow up alone in 44.4%. Surgical treatment showed higher rates of complete response compared to other modalities. Complications were infrequent, with minor complications occurring in 4.6% and major complications in 1.9% of participants. Recurrence was noted in 2.8% of cases during the follow up period. Overall, treatment approaches were well tolerated with favorable short and intermediate term outcomes.

LABORATORY ANALYSIS:

Laboratory investigations demonstrated that most participants had stable baseline clinical parameters. Complete blood count values were within normal limits in 80 participants, while 28 showed abnormalities. Renal function tests were normal in 90 cases, and liver function tests were normal in 85 cases. Serum electrolyte levels were within normal range in 95 participants, while 13 showed abnormalities. Random blood sugar levels were normal in 98 participants, and PT/INR values were normal in the majority, with abnormalities observed in 8 cases. (Table 2).

Table 2
Laboratory Analysis

Investigation Type	Normal Findings (n)	Abnormal Findings (n)
Complete Blood Count (CBC)	80	28
Renal Function Tests (RFT)	90	18
Liver Function Tests (LFT)	85	23
Serum Electrolytes	95	13
Glucose Random Blood Sugar (GRBS)	98	10
Prothrombin Time/INR	100	8

AVERAGE LENGTH OF HOSPITAL STAY BY TREATMENT TYPE:

The average length of hospital stay varied according to the type of treatment received. Patients undergoing surgical intervention had the longest hospital stay, with a mean duration of 5.2 days and a median of 5 days. Medical management was associated with a mean hospital stay of 3.8 days and a median of 4 days. Participants managed with follow up alone had the shortest stay, with a mean duration of 1.5 days and a median of 1 day (Fig. 3).

PRESENTATION SYMPTOMS:

The most common presenting symptom was self-detection of a breast lump, reported by 46.3% of participants. Pain was reported by 27.8%, followed by nipple discharge in 13.9% of cases. Changes in breast shape were noted in 9.3%, while skin changes such as redness or dimpling were reported by 7.4% (Table 3).

Table 3
Symptoms

Symptom	n (%)
Lump Discovered by Self-Examination	50 (46.3%)
Pain	30 (27.8%)
Nipple Discharge	15 (13.9%)
Change in Breast Shape	10 (9.3%)
Skin Changes (e.g., redness, dimpling)	8 (7.4%)

IMAGING FINDINGS:

Imaging findings varied across modalities. Ultrasonography identified 65 benign lesions, 5 malignant lesions, and 5 indeterminate findings. Mammography demonstrated 30 benign and 10 malignant lesions, while MRI identified 15 benign and 5 malignant lesions, with no indeterminate results (Table 4).

Table 4
Imaging findings

Imaging Modality	Benign Findings (n)	Malignant Findings (n)	Indeterminate Findings (n)
Ultrasound	65	5	5
Mammography	30	10	0
MRI	15	5	0

Table 5
Treatment type

Treatment Type	18–24 (n)	25–30 (n)	31–35 (n)	36–40 (n)
Surgical Intervention	10	15	10	5
Medical Management	8	12	5	3
Follow-Up	16	8	5	5

RESPONSE TO INTERVENTIONS:

Among participants undergoing surgical intervention, 87.5% achieved complete response and 12.5% had partial response, with no cases of treatment failure. Medical management resulted in complete response in 75.0% and partial response in 25.0% of cases. Participants managed with follow up alone showed complete response in 62.5%, partial improvement in 20.8%, and no response in 16.7%.

FOLLOW UP OUTCOMES:

During the 0–6 month follow up period, recurrence was observed in 5.0% of participants, while 70.0% reported no symptoms. At 6–12 months, recurrence decreased to 2.5%, with 80.0% of participants remaining asymptomatic. No recurrences were observed during the 13–24 month follow up interval, and only 7.5% reported persistent symptoms. **A progressive improvement in outcomes was observed with increasing duration of follow up** (Fig. 4).

PARTICIPANT CHARACTERSTICS BY TREATMENT TYPE AND AGE GROUP:

The distribution of participants by treatment type and age group showed a normal pattern across interventions. For surgical intervention, the highest number of participants (15) were aged 25–30 years, with equal numbers (10 each) in the 18–24 and 31–35 age groups, and the fewest (5) in the 36–40 group. Medical management was most common among younger age groups, with 8 participants aged

18–24 and 12 aged 25–30. Fewer participants received medical treatment in the older groups (5 in 31–35 and 3 in 36–40). Follow up care was predominantly attended by the youngest group (16 in 18–24), followed by 5 attendees each in the 25–30, 31–35, and 36–40 age ranges. These findings suggest a tendency for older patients to opt for surgery, while younger patients more frequently choose follow up care.

DISCUSSION

In our study most participants were young women from rural backgrounds who detected breast lumps through self-examination, commonly presenting with pain or nipple discharge. Ultrasonography was the primary diagnostic tool, and histopathology confirmed predominantly benign lesions, followed by malignant and atypical changes. Surgical management showed the highest complete response rates, with conservative approaches effective in selected cases. Recurrence and symptom persistence decreased over follow up, with no recurrences after 12 months, and older patients were more likely to undergo surgical intervention.

Numerous studies have demonstrated that advanced tumor stage, nodal involvement, and distant metastases at diagnosis are associated with poorer outcomes in women under 40 diagnosed with breast cancer. [6,7,8] Accurate diagnosis requires a solid understanding of clinical features, including incidence, age distribution, and symptoms. [9]

Our study demonstrates socio-economic and geographic disparities, with rural participants being younger, more likely to marry early, and having lower educational attainment, whereas semi-urban participants showed higher education levels and delayed marriage, reflecting greater socio-economic mobility. Fredholm et al. (2009) also emphasized age in breast cancer prognosis, showing worse survival in women under 35 compared to those aged 40–49, who had the most favorable outcomes. [10] This difference was attributed to aggressive tumor biology rather than treatment efficacy, highlighting age as a critical factor from both socio-demographic and biological perspectives.

Our findings are consistent with Ozoilo et al., who reported low educational attainment and high unemployment among women, indicating socio-economic vulnerability.[11] Limited economic resources adversely affect awareness and access to healthcare.[12] In the present study, more than half of participants in both groups had a monthly income below ₹5,000, although semi-urban women demonstrated higher educational attainment, suggesting greater potential for socio-economic mobility. These observations are supported by evidence linking education and occupational diversity to improved income and economic resilience.[13,14,15]

Ultrasonography was the most commonly used diagnostic modality (69.4%), reflecting its accessibility, cost effectiveness, and reliability in young women, with mammography and MRI used selectively for further evaluation, consistent with findings reported by Saleh et al. (2023).[16] Similarly, Amal et al. observed that most malignant breast lesions in young women appeared as masses on MRI, commonly

exhibiting irregular shape (70.0%), irregular margins (45.0%), heterogeneous enhancement (87.5%), and a washout enhancement pattern, findings that are consistent with established imaging characteristics of breast cancer in younger patients. [17]

Treatment outcomes in our study further support the effectiveness of current protocols, with surgical intervention performed in 37.0% of cases, accompanied by low complication rates (4.6% minor, 1.9% major) and a recurrence rate of 2.8%. However, literature highlights the increased risk of local recurrence in young women following breast conserving therapy. Henzler et al. [18] reported that women under 35 years have a nine fold higher risk of local recurrence, even with early stage tumors. Similarly, Nguyen et al. [19] observed that young women undergoing breast conserving therapy experience approximately a 2.5 fold increased risk of local recurrence. Follow up assessments (44.4%) indicate a proactive care model. Zhao et al. (2023) similarly reported low complication and recurrence rates for surgical breast care [20], while Chetry et al emphasized follow-up's role in early problem detection and improved outcomes. [21]

Hospital stay analysis revealed that surgical patients had longer stays (mean 5.2 days) compared to those receiving medical treatment (3.8 days) or follow up care (1.5 days). Weiser et al. (2024) found similar trends, noting longer stays were necessary for postoperative care and monitoring. [22]

A significant portion of participants (46.3%) discovered their breast lumps through self-examination, highlighting the importance of awareness. Pain (27.8%) and nipple discharge (13.9%) were other common symptoms, with fewer reporting changes in breast shape (9.3%) or skin (7.4%). This aligns with Khan et al. (2016), who reported painless lumps as the most frequent symptom [23], consistent with Memon et al. (2006) [24] but contrasting with Krishnaswamy (2003), who found pain to be most common. [25]

The predominance of benign lesions underscores the necessity of histological evaluation to guide management. The presence of atypical hyperplasia highlights the need for close monitoring due to its association with higher cancer risk. Thangjam et al. (2014) also observed that most young women presented with advanced stage malignancies, reinforcing the need for early intervention. [26]

Treatment responses were more favorable with active interventions, with surgical management showing a higher proportion of complete responses (87.5%), followed by medical treatment (75.0%), while patients managed with follow up alone demonstrated comparatively lower complete response rates (62.5%). These findings suggest that immediate therapeutic interventions may be associated with improved short term outcomes, whereas longer term management may benefit from individualized care strategies tailored to patient specific needs, as also emphasized by Smith et al. (2016).[27]

Follow-up outcomes showed clear improvement over time: recurrence rates dropped from 5.0% at 0–6 months to 0% by 13–24 months, and the proportion of patients reporting no issues rose from 70.0% to 92.5%. These patterns affirm the effectiveness of treatment and the value of ongoing follow up.

Pashayan et al. (2020) similarly demonstrated that follow up care reduces recurrence and improves outcomes. [28]

Treatment preferences varied with age, with younger patients more often opting for follow up and those aged 25–30 favoring surgical management, possibly reflecting differences in health literacy and risk perception. Similar age related patterns and the value of tailored, culturally appropriate education and communication have been reported in previous studies.[29–32]

This study underscores the importance of early detection and patient awareness, with nearly half of breast lumps identified through self examination. Ultrasonography emerged as the most accessible and effective diagnostic tool, supplemented by mammography and MRI when required. Surgical management showed high efficacy with low complication and recurrence rates, although individualized strategies may be needed for younger women at risk of local recurrence. Structured follow up facilitated effective outcome monitoring, and the findings highlight the need to address rural-urban disparities in breast health data and to integrate mental health support for patients with benign breast conditions.

Given the scarcity of published cohort data from non-urban regions, the present findings contribute novel regional evidence and highlight the importance of structured diagnostic algorithms and follow up models applicable to similar healthcare systems globally.

CONCLUSION

This study demonstrates socio-economic and healthcare differences in the presentation and management of breast lumps among women aged 18–40 in rural and semi-urban populations. Rural women, with lower education levels and earlier age at marriage, had delayed presentations compared to semi-urban women. Self-examination was the most common method of detection, and ultrasonography proved to be the primary imaging modality. Surgical intervention had the highest success, with low complication (4.6% minor, 1.9% major) and recurrence (2.8%) rates. Variation in outcomes across treatment types highlights the need for tailored management strategies and systematic follow up.

LIMITATIONS

This single center study may have limited generalizability, with potential selection bias and incomplete follow up, particularly among rural participants. Diagnostic variability, modest sample size, limited follow up duration, and lack of assessment of genetic and psychological factors may have influenced outcome estimates.

Abbreviations

FNAC
Fine needle aspiration cytology
MRI

Magnetic resonance imaging
CBC
Complete blood count
RFT
Renal function tests
LFT
Liver function tests
PT/INR
Prothrombin time/International normalized ratio

Declarations

ETHICS APPROVAL AND CONSENT TO PARTICIPATE:

This study was approved by the Institutional Ethics Committee of Kasturba Medical College (IEC KMC MLR 03/2024/175). Written informed consent was obtained from all participants prior to enrolment.

CLINICAL TRIAL NUMBER:

Not Applicable.

CONSENT FOR PUBLICATION:

Written informed consent for publication of anonymized clinical data was obtained from all participants.

COMPETITING INTERESTS:

The authors declare that they have no competing interests.

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Author Contribution

AK collected data and drafted the manuscript. AMS performed data analysis and manuscript revision. SKS conceptualized the study, supervised the research, and critically reviewed the manuscript. All authors read and approved the final manuscript.

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Data Availability

All data generated or analyzed during this study are included in this published article. Additional data are available from the corresponding author on reasonable request.

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Figures

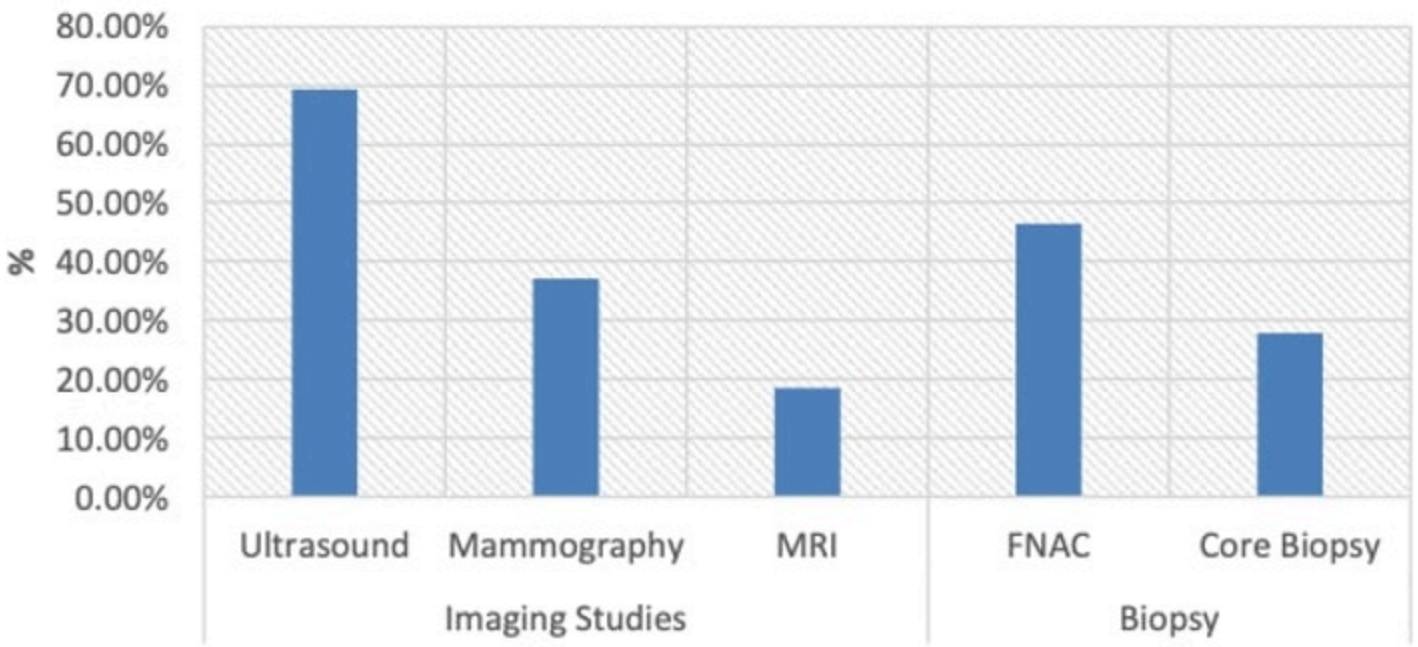


Figure 1

Diagnostic technique

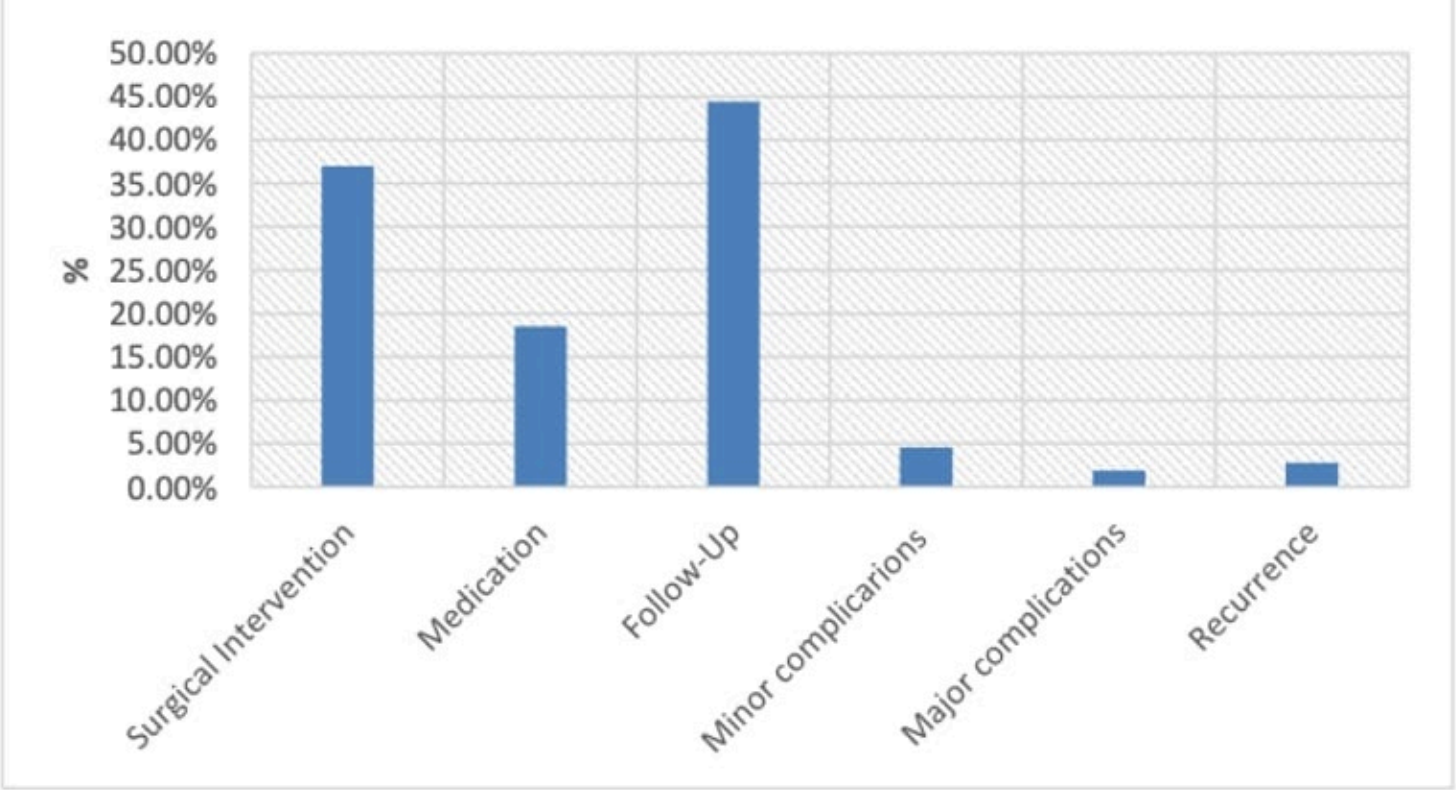


Figure 2

Treatment Outcomes

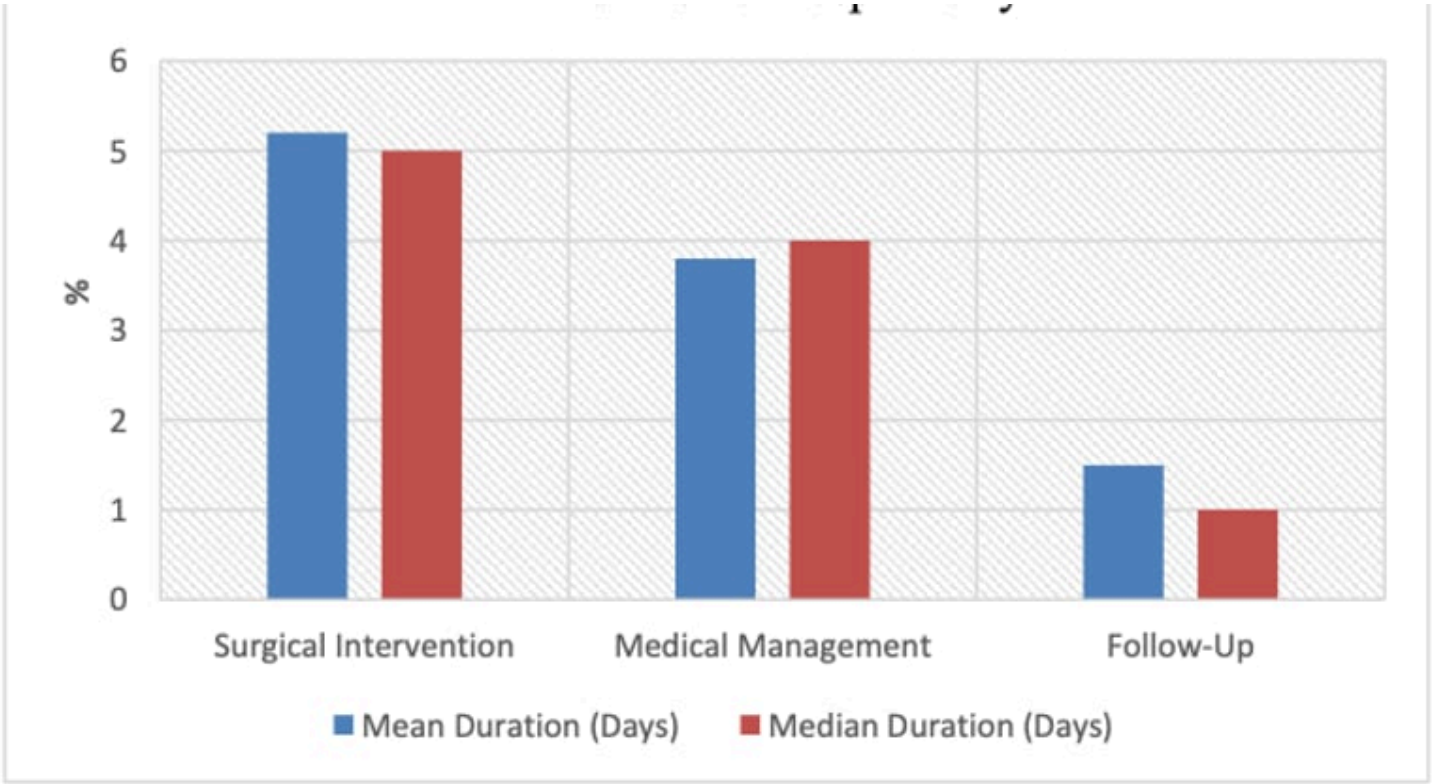


Figure 3

Duration of hospital stay

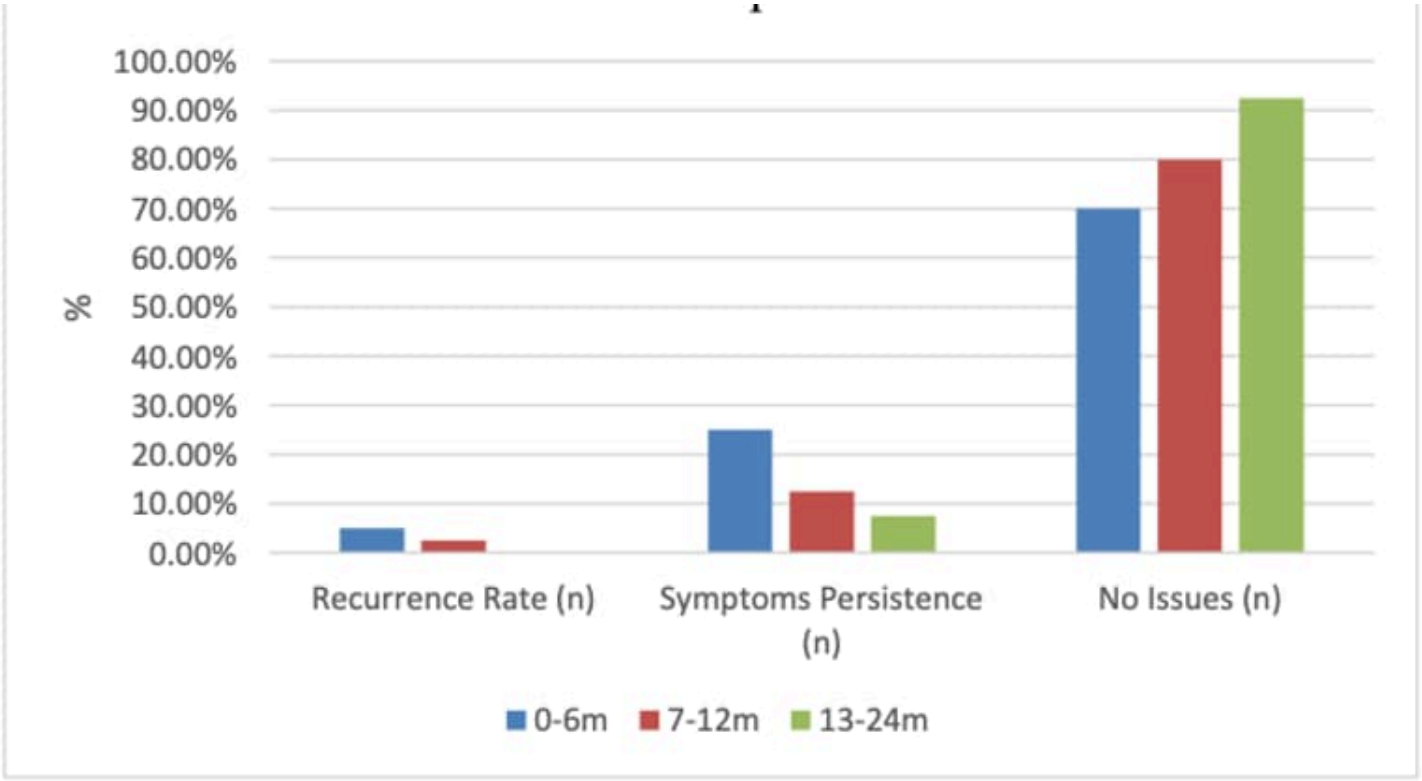


Figure 4

Follow up outcomes