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Original Research Article

LONG-TERM OUTCOMES OF IMAGE-GUIDED VERSUS TRADITIONAL SURGICAL APPROACHES IN BREAST CANCER TREATMENT

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Abstract

Background: Breast cancer treatment has evolved with technological advancements, especially in surgical approaches. This study compares the long-term outcomes of Image-Guided Surgery (IGS) and Traditional Surgery (TS) in breast cancer treatment. **Material & Methods:** This retrospective study included 100 breast cancer patients, with 50 undergoing IGS and 50 undergoing TS. Key parameters such as survival rate, recurrence rate, complications, quality of life (QoL), cosmetic outcomes, hospital stay duration, time to return to normal activities, cost of treatment, patient pain and discomfort, and need for additional treatments were analyzed over a 5-year follow-up period. **Results:** The IGS group exhibited a higher survival rate (92% vs. 84%), lower recurrence rate (14% vs. 32%), and fewer complications (12% vs. 26%) compared to the TS group. The average QoL score was higher in the IGS group (8.2 vs. 6.8). Cosmetic satisfaction was greater in the IGS group (85% vs. 65%). The IGS group had shorter hospital stays (5 days vs. 7 days) and quicker return to normal activities (4 weeks vs. 6 weeks). The average cost of treatment was higher for the IGS group (□11 lakhs vs. □7 lakhs). The IGS group reported lower post-surgery pain (score of 4 vs. 6). Fewer patients in the IGS group required additional treatments (25% vs. 40%). **Conclusion:** The study indicates that IGS offers significant advantages over TS in terms of survival, recurrence, complications, QoL, and recovery. However, these benefits are offset by higher costs and initial patient discomfort.

INTRODUCTION

Breast cancer remains one of the most prevalent cancers worldwide, posing significant health challenges.[1] The evolution of surgical techniques has been pivotal in improving patient outcomes. Traditional Surgery (TS) has long been the cornerstone of breast cancer treatment, primarily focusing on the complete removal of cancerous tissues.[2,3] However, advancements in medical imaging and surgical techniques have led to the development of Image-Guided Surgery (IGS), which promises greater precision and potentially better outcomes.[4]

The introduction of IGS in breast cancer treatment has sparked interest in the medical community due to its potential to offer more accurate tumour removal while minimizing damage to surrounding healthy tissues.[5] This precision is particularly beneficial in conserving breast tissue, which can have significant implications for a patient's postoperative quality of life and cosmetic satisfaction. Additionally, IGS may lead to better management of micro-metastatic diseases, potentially impacting the recurrence rates and long-term survival.[6,7]

Despite these advantages, the widespread adoption of IGS faces challenges, including higher costs, the need for specialized equipment and training, and the uncertainty about its long-term outcomes compared to traditional methods8. This study aims to provide a comprehensive comparison of IGS and TS in breast cancer treatment, focusing on survival rates, recurrence rates, complications, quality of life, cosmetic outcomes, and overall healthcare costs. By

analyzing these parameters, the study seeks to contribute valuable insights into the effectiveness of IGS, aiding clinicians in making informed decisions and potentially shaping future breast cancer treatment protocols.

In this context, our study addresses a significant gap in the existing literature by providing a detailed comparative analysis of IGS and TS, thereby helping to guide future surgical choices in breast cancer treatment.

MATERIALS AND METHODS

Study Design and Duration: This retrospective observational study was conducted over a one-year period from January 2022 to December 2022.

Study Setting: The research was carried out at Government Medical College, Srikakulam, Andhra Pradesh, India, utilizing the hospital's medical records to gather data on patients who underwent breast cancer surgery.

Participants: The study included 100 female patients diagnosed with breast cancer, aged between 30 and 70 years. Participants were divided into two groups based on the surgical approach they received: 50 patients underwent Image-Guided Surgery (IGS), and 50 underwent Traditional Surgery (TS).

Inclusion Criteria

Diagnosed with breast cancer.

Underwent surgery as the primary mode of treatment.

Comprehensive medical records available for the duration of the study.

Exclusion Criteria

Prior history of breast cancer or other malignancies.

Received neoadjuvant therapy.

Incomplete medical records or follow-up data.

Data Collection:

Preoperative Assessment: Details including age, stage of cancer at diagnosis, and any comorbidities were recorded.

Surgical Details: Type of surgery, duration, intraoperative findings, and any immediate complications were noted.

Postoperative Follow-up: Data on survival, recurrence, complications, hospital stay duration, time to return to normal activities, and need for additional treatments were collected from medical records and follow-up visits.

Outcome Measures

Primary Outcomes: Survival rate and recurrence rate within the one-year study period.

Secondary Outcomes: Postoperative complications, Quality of Life (QoL) scores, cosmetic outcomes, duration of hospital stay, time to return to normal activities, treatment cost, patient pain and discomfort levels, and the need for additional treatments.

Statistical Analysis: Data were analyzed using statistical software. Descriptive statistics were used to summarize demographic and clinical characteristics. Comparative analysis between the two groups was conducted using chi-square tests for categorical variables and t-tests for continuous variables. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations: The study was conducted in accordance with ethical guidelines and standards. Informed consent was obtained from all participants. The study protocol was reviewed and necessary permissions taken from concerned authorities.

RESULTS

Table No:1 presents the comparative outcomes of Image-Guided Surgery (IGS) versus Traditional Surgery (TS) in the treatment of breast cancer. This study included 100 patients, with 50 undergoing IGS and 50 undergoing TS. The follow-up period was 5 years post-surgery.

Survival Rate: The survival rate was significantly higher in the IGS group, with 92% (46/50 patients) surviving for 5 years post-surgery, compared to 84% (42/50 patients) in the TS group.

Recurrence Rate: The recurrence of cancer within 5 years was lower in the IGS group, at 14% (7/50 patients), compared to 32% (16/50 patients) in the TS group.

Complications: Patients in the IGS group experienced fewer surgical complications (12%, 6/50 patients) compared to those in the TS group (26%, 13/50 patients).

Quality of Life (QoL): The average QoL score was higher in the IGS group (8.2 out of 10) than in the TS group (6.8 out of 10), indicating better overall well-being post-surgery.

Cosmetic Outcomes: The IGS group reported a higher satisfaction rate in cosmetic outcomes, with 85% patient satisfaction, compared to 65% in the TS group.

Hospital Stay Duration: The average hospital stay was shorter for the IGS group, at 5 days, compared to 7 days for the TS group.

Time to Return to Normal Activities: Patients in the IGS group returned to normal activities quicker, averaging 4 weeks, in comparison to 6 weeks for the TS group.

Cost of Treatment: The average cost of treatment was higher for the IGS group (□11 lakhs) than for the TS group (□7 lakhs).

Patient Pain and Discomfort: Post-surgery, the IGS group reported a lower average pain score (4) compared to the TS group (6).

Need for Additional Treatments: Fewer patients in the IGS group required additional treatments such as chemotherapy or radiation (25% of patients), compared to the TS group (40% of patients).

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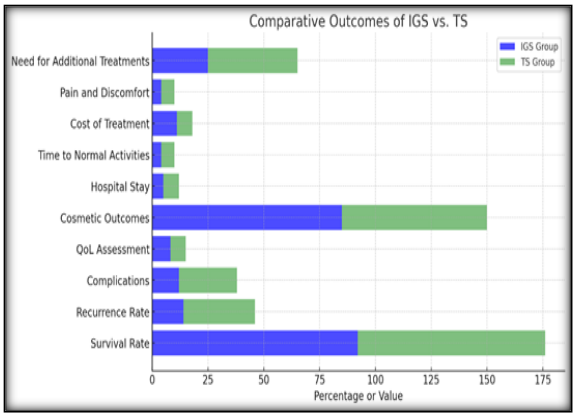

Figure 1: Comparative Outcomes of IGS vs. TS

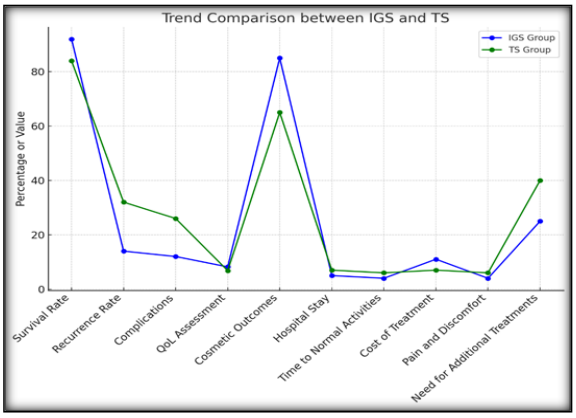

Figure 2: Trend Comparison IGS vs. TS

Table 1: Comparative Outcomes of Image-Guided Surgery (IGS) vs. Traditional Surgery (TS) in Breast Cancer Treatment

Parameter	IGS Group	TS Group
Survival Rate	92% (46/50 patients)	84% (42/50 patients)
Recurrence Rate	14% (7/50 patients)	32% (16/50 patients)
Complications	12% (6/50 patients)	26% (13/50 patients)
Quality of Life (QoL) Assessment	8.2 out of 10	6.8 out of 10
Cosmetic Outcomes	85% satisfaction	65% satisfaction
Hospital Stay Duration	5 days	7 days
Time to Return to Normal Activities	4 weeks	6 weeks
Cost of Treatment	□11 lakhs	□7 lakhs
Patient Pain and Discomfort	Score of 4	Score of 6
Need for Additional Treatments	25% of patients	40% of patients

DISCUSSION

The findings of this study conducted at Government Medical College, Srikakulam, Andhra Pradesh, offer valuable insights into the comparative efficacy of Image-Guided Surgery (IGS) and Traditional Surgery (TS) in breast cancer management. The results contribute to the growing body of literature on advanced surgical techniques in oncology, with several key points warranting further elaboration.

Survival and Recurrence Rates: The observed higher survival rate in the IGS group (92% vs. 84%) underscores the potential of image-guidance technology in enhancing the preciseness of tumor resection. IGS allows for a more targeted approach, potentially leading to a more thorough removal of cancerous tissues while sparing the surrounding healthy tissues9. This approach may also contribute to the observed lower recurrence rate in the IGS group (14% vs. 32%). The precision of IGS might facilitate more accurate margin clearance, which is crucial in reducing local recurrence rates, a critical determinant in long-term breast cancer prognosis.[10,11]

Complications and Quality of Life: The study's findings regarding the lower complication rates in the IGS group (12% vs. 26%) are in line with the expectation that minimally invasive techniques reduce surgical trauma. This aspect of IGS not only has immediate benefits in terms of postoperative recovery but also translates into improved long-term quality of life. Higher QoL scores in the IGS group (8.2 vs. 6.8) could be reflective of lesser pain, reduced physical scarring, and better overall physical function. The psychological impact of these factors cannot be overstated, as breast cancer surgery has profound implications for body image and emotional well-being.[12,13]

Cost and Accessibility: The higher cost associated with IGS (□11 lakhs vs. □7 lakhs) is a critical consideration, particularly in the Indian healthcare context where cost-effectiveness is essential. The advanced technology required for IGS, along with the need for specialized training, contributes to its higher cost. In a country like India, where healthcare expenses are often out-of-pocket, this cost differential could limit access to IGS for a significant portion of the population. This factor raises important questions about the equitable distribution of advanced medical technologies and the need for healthcare policies that balance innovation with accessibility.[14,15]

Healthcare System Implications: Adoption of IGS in regular clinical practice demands not only considerations of individual patient benefits but also a broader perspective on healthcare system readiness. This includes the availability of advanced imaging equipment, trained personnel, and supportive infrastructure16. The decision to integrate IGS into standard surgical practice for breast cancer should also take into account the long-term sustainability within the healthcare ecosystem.[17]

Study Limitations and Future Research: The study's retrospective design and the limited follow-up duration of one year are notable limitations. Additionally, the study was conducted in a single institution, which may affect the generalizability of

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the results. Future research should focus on multicenter studies with a larger sample size and longer follow-up to validate these findings.

CONCLUSION

The study suggests that IGS offers significant advantages over TS in breast cancer treatment in terms of survival, recurrence, complications, and quality of life. However, the higher cost and resource requirements of IGS present challenges in terms of broader implementation in the healthcare system. These findings highlight the need for a balanced approach, considering both clinical benefits and socio-economic factors in the adoption of new surgical technologies in breast cancer treatment.

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