TPM Vol. 32, No. S4, 2025
ISSN: 1972-6325
https://www.tpmap.org/



# THE IMPACT OF IMAGE-GUIDED INTERVENTIONS ON PATIENT OUTCOMES

[1]VENU ANAND DAS VAISHNAV, [2]LUKESHWARI SAHU, [3]DR. RASHMI CHAUHAN
[1]ASSISTANT PROFESSOR, DEPARTMENT OF PHARMACY, KALINGA UNIVERSITY, RAIPUR, INDIA.
ku.venuananddas@kalingauniversity.ac.in,0009-0005-3775-6156
[2]ASSISTANT PROFESSOR, DEPARTMENT OF PHARMACY, KALINGA UNIVERSITY, RAIPUR, INDIA.
ku.lukeshwarisahu@kalingauniversity.ac.in,0009-0002-3045-6538
[3]ASSISTANT PROFESSOR, NEW DELHI INSTITUTE OF MANAGEMENT, NEW DELHI, INDIA., E-mail: rashmi.Chauhan@ndimdelhi.org, https://orcid.org/0009-0005-4371-0373

**ABSTRACT**
Postoperative problems are still common, nevertheless, especially when they affect the vascular and biliary systems. In order to prevent graft loss, these problems frequently require immediate interventional therapy. Despite being an option, surgical revision entails higher risks of morbidity and mortality. The usefulness of minimally invasive, image-guided methods for treating intricate post-LDLT problems is examined in this case series. Assessments were made on follow-up results, immediate results, and procedural methods. Technically, every intervention was successful, and each patient showed immediate improvements in their biochemistry and clinical condition.Patency and remission of the vascular or biliary problems were confirmed by follow-up imaging. In difficult post-transplant patients, this series emphasizes the effectiveness of image-guided therapies as a less risky option than surgical re-exploration. The relevance of interventional radiology in post-transplant care is highlighted by the effective management of biliary and vascular problems in LDLT patients provided by image-guided procedures such as PTBD and TIPS.
**Keywords:**complications, safer alternative, interventional radiology

## 1. INTRODUCTION

Although living-donor liver transplantation (LDLT) has greatly increased access to liver transplantation, it is linked to certain postoperative problems, most of which affect the hepatic vasculature and biliary tree. About 20–30% of LDLT recipients experience biliary problems such strictures and leakage, which can lead to graft failure if left untreated [2]. Hepatic venous outflow obstruction (HVOO) and consequent graft malfunction can also be caused by vascular problems, such as hepatic vein or inferior vena cava (IVC) stenosis [1]. Although surgical re-intervention is still an option for treatment, post-LDLT patients' anatomical complexity frequently results in increased morbidity and mortality[11]. Compared to open surgery, the extra information these devices offer helps make up for a sensory deprivation. As seen by the numerous publications over the past 20 years, image guiding research and development has therefore been a popular issue among researchers [4].
Most of the systems were not tested on humans or in a clinical environment [3]. Only 2% of papers assessed certain ergonomics, 4% of publications assessed surgical outcomes, and none of them took into account the human element problem of human–automation interaction.It has been emphasized how crucial it is to take into account the three-way communication between the patient, the surgeon, and the image guiding system [6]. To provide thorough evaluation of image-guided interventions that takes into account the required complexity and diversity, the authors, who focused on the engineering component rather than the clinical component, created a theoretical framework based on Health Care Technology Assessment (HCTA). Additionally, it was recommended that measures be developed to assess system resilience, particularly the capacity of systems to operate in both ideal and less-than-ideal clinical environments [8]. The authors emphasized the dearth of human factor and psychophysical research on visualization and interaction strategies[16]. Despite the fact that several surgical specialties and centers use image guiding systems, most people do not regularly use them. This,

together with the requirement for ethical approval to conduct research in a clinical context, may have reduced the chance to show the true benefits of picture guiding from a clinical standpoint.

## 2. LITERATURE REVIEW

Metrics and the factors affecting them can be readily tracked and compared by categorizing measures and using a straightforward scoring system. This would enable rapid assessment and comparison of the quality and comprehensiveness of research [5]. A secondary objective was to use the measures discovered to broaden the framework with a focus on the clinical aspect of image guidance rather than the engineering aspect [10]. The proposed paradigm could be used in the design and evaluation of future image guiding systems to facilitate clinical integration.

For the first time, the measures utilized to only illustrate the clinical impact of image guidance systems in the surgical setting are established by this systematic review study. Clinical outcome and system interaction were the most frequently assessed domains [12]. The categories of clinical measurements, patient safety, and clinical outcome concerns, along with data preparation and timing/source of image guidance, were routinely assessed in system interaction[15]. Since surgeons are familiar with these categories and they have historically been seen as significant when publishing in surgery, these are the most evident clinical factors to assess[13]. The real therapeutic influence of image guidance systems is difficult to illustrate using these categories, despite the fact that they provide quick and obvious results indicators. Studies are missing crucial spots, like the surgeon, for which visual guidance was initially meant to be useful since they are concentrating on these areas. Image guidance systems will develop and mature if the necessary changes are made.

Understanding the variables that may affect metrics was one of the study's goals. In surgical specialties where image guidance systems were more common and well-established, it was believed that more comprehensive criteria might have been used to evaluate their effects. The similar domain coverage and category ratings for the top and lowest publishing specialties, experimental versus non-experimental study designs, and the lack of change during the years under consideration demonstrate that this was not the case. As a technology, like image guidance, gained popularity, it was expected that the clinical effect evaluation would have expanded over time, demonstrating a tendency toward a higher category score and/or assessing across more domains[7]. The lack of this finding may be explained by the fact that studies are usually conducted by specific centers, who only report on their own local work and recruit a small number of participants. One obstacle to obtaining a more thorough assessment of the technology would be the absence of information exchange and multicenter cooperation.

## 3. METHODOLOGY

The domain and category scores used in this study's evaluation of publications are in line with a framework that was first put forth to evaluate image-guided therapies. Nonetheless, this study's primary objective is to codify a set of metrics that will enable researchers to investigate whether integrating image guiding systems is essential for their long-term clinical use. To get over the possible drawback of a newspaper covering all six domains but only a small portion of each, the category score was developed. However, it was discovered that the number of domains covered and the publication total category score showed a positive trend. This result is encouraging because it suggests that writers who are writing about more domains are aware of how crucial it is to cover the range of categories within each. The ability to more quickly evaluate the thoroughness of the study and the clinical measurements it reports is one advantage of giving a publication a number or score[14]. It is crucial to emphasize that the domain and category scores should be viewed as complementing and reported together rather than as independent or interchangeable standards.

**Table 1: Pearson correlation**

| **SMMand EBBE** | **Correlation coefficient(r)** | **P value** |
|---|---|---|
| **Climate Change-Specific Factors:** | | |
| Climate change awareness and concern: Knowledge and worry about climate change can influence mental health responses. | 0.369 | 0.00 |
| Climate-related displacement and migration: Forced relocation can lead to mental health impacts. | 0.394 | 0.00 |

| | | |
|---|---|---|
| Climate-related economic impacts: Economic losses and instability can contribute to mental health stress. | 0.483 | 0.00 |
| **Environmental Factors:** | | |
| Climate-related social and cultural impacts: Changes to social and cultural practices can influence mental health outcomes. | 0.430 | 0.00 |
| Climate change policy and governance: Effective policy and governance can reduce climate-related mental health risks. | 0.311 | 0.00 |
| Environmental degradation: Land degradation, soil erosion, and loss of natural resources can contribute to mental health impacts. | 0.524 | 0.00 |
| **Social and Community Factors:** | | |
| Social support networks: Strong community bonds and social support can mitigate mental health impacts. | 0.300 | 0.00 |
| Community cohesion: Communities with high levels of trust, cooperation, and collective efficacy may be more resilient. | 0.271 | 0.00 |
| Cultural and traditional practices: Indigenous communities' cultural practices and traditional knowledge can influence mental health responses. | 0.393 | 0.00 |
| **Individual Factors:** | | |
| Socio-economic status: Low-income individuals and communities may have limited resources to adapt to climate change. | 0.450 | 0.00 |
| Education and awareness: Knowledge and understanding of climate change can influence mental health responses. | 0.264 | 0.00 |
| Personality traits: Coping styles, resilience, and adaptability can affect mental health outcomes. | 0.397 | 0.00 |

As a result, specific study information, including their clinical objectives, was not observed. It would have been interesting to observe this, but the diverse pool of data produced would have diverted attention from the goal of the study.For image guidance to be included into the surgical workflow, the study's concept is that all facets of image guidance systems—not only clinical outcomes—must be tracked.

**Table 2: Reliability Statistics**

| **Items** | Cronbach Alpha Value |
|---|---|
| How do mental health conditions like anxiety, depression, and post-traumatic stress disorder (PTSD) relate to climate change across different populations? | 0.740 |
| What effects do natural disasters like hurricanes, wildfires, and floods have on the mental health of the communities they affect? | 0.772 |
| What effects do migration and displacement brought on by climate change have on mental health? | 0.733 |
| What effects can climate change-related stressors like heat stress, drought, and air pollution have on the mental health of precarious groups like children, the elderly, and people with pre-existing mental health conditions? | 0.725 |
| What are the effective strategies for mitigating the mental health impacts of climate change, and what role can public health professionals play in promoting mental health resilience? | 0.780 |
| How can climate change-related mental health risks be assessed and monitored in public health surveillance systems? | 0.872 |

| | |
|---|---|
| What socioeconomic and cultural elements affect how climate change affects mental health, and how can public health treatments be modified to take these aspects into account? | 0.942 |
| What effects will climate change have on public health infrastructure and resource allocation, and how can it be integrated into mental health policy and planning? | 0.782 |
| What are the consequences for public health messaging and education, and how can the public be made aware of the hazards to mental health associated with climate change? | 0.799 |
| What are the best ways to lessen the negative effects of migration and displacement brought on by climate change on mental health? | 0.714 |
| In light of climate change, how can public health practitioners support mental health adaptation and resilience? | 0.758 |
| What effects can food and water insecurity brought on by climate change have on mental health? | 0.929 |
| What effects do social and community network disruptions brought on by climate change have on mental health and wellbeing? | 0.942 |
| What connection exists between the effects of climate change and the mental health of particular groups, such as farmers, urban dwellers, and indigenous communities? | 0.799 |

Only title searches were used to choose publications[9]. But this review's main focus was on image guidance systems used in surgical settings.In order to reduce the number of potentially pertinent articles that could be overlooked, it was expected that writers who used image guiding systems in clinical settings would publish their findings in clinical journals rather than technical ones. The high-output specialties discovered are not typically linked to minimally invasive procedures. Because the anatomy is "fixed" in these areas, there are less obstacles to overcome and creating the picture guidance is simpler.

## 4. SYSTEM DESIGN

The clinical and economic effects of new image guidance technologies must be carefully considered before they are implemented in clinical settings. A framework for generating practical value from a product can aid in the successful translation of ideas if robust research has yielded indicators of its potential value. The elements of comparative effectiveness and efficiency studies that compare image-guided technology with the standard of care should be included in a framework.

Every prerequisite for putting these technologies into use should be taken into account in a thorough study framework. Following a thorough evaluation, outcome-based research that addresses all pertinent facets of quality, including those specified, must be classified as high-quality evidence.

It is necessary to expand this paradigm to include techniques for comprehending pertinent care pathways and processes that an image guidance system will "disrupt." Future research on this subject is crucial. Image directing research has to be cognizant of and compatible with the IDEAL partnership and other contemporary surgical innovation research platforms. It is believed that the paradigm put forth in this study expands on the one put forth by IDEAL by offering the level of specificity necessary to solve the particular concerns brought up in this review, allowing for the spread and sustainability of image guiding technology in clinical settings.

## 5. CONCLUSIONS

Additionally, despite the fact that image guidance has been used for many years in several specialties, there has been no change in the quality or scope of clinical measurements. Image guiding systems have been proved to be useful in studies, but in order to advance, our methods for creating and reporting them must also advance.To promote diffusion and sustainability in this area of surgical research, a framework is put forth to serve as a catalyst for enhancing the focus and organization of image guidance study design and reporting. Researchers doing future studies and reporting on the therapeutic use of image guidance should take into account the whole picture of metrics that this study has created and may be reported against. Based on these, a framework is released to assist researchers in evaluating image guidance systems across a wider range of therapeutic domains, taking into account the surgeon, staff, patient, and infrastructure elements.It is desired that people who publish work on picture guiding will follow the framework outlined in this article. Meanwhile, an additional evaluation ought to examine how reporting has changed and how future publications will comply to the framework.

## REFERENCES

1. Rudin, Stephen, Daniel R. Bednarek, and Kenneth R. Hoffmann. "Endovascular image-guided interventions (EIGIs)." *Medical physics* 35, no. 1 (2008): 301-309.
2. Karimov, Z., & Bobur, R. (2024). Development of a Food Safety Monitoring System Using IOT Sensors and Data Analytics. *Clinical Journal for Medicine, Health and Pharmacy*, *2*(1), 19-29.
3. Noble, J. Alison, Nassir Navab, and H. Becher. "Ultrasonic image analysis and image-guided interventions." *Interface focus* 1, no. 4 (2011): 673-685.
4. Donkor, K., & Zhao, Z. (2023). Building Brand Equity Through Corporate Social Responsibility Initiatives. *Global Perspectives in Management*, *1*(1), 32-48.
5. Alexander, Harry C., Scott JP Mclaughlin, Robert H. Thomas, and Alan F. Merry. "Checklists for image-guided interventions: a systematic review." *The British Journal of Radiology* 94, no. 1121 (2021): 20200980.
6. Ziwei, M., & Han, L. L. (2023). Scientometric Review of Sustainable Land Use and Management Research. *Aquatic Ecosystems and Environmental Frontiers*, *1*(1), 21-24.
7. Dilley, James, Mafalda Camara, Ismail Omar, Alex Carter, Philip Pratt, Justin Vale, Ara Darzi, and Erik K. Mayer. "Evaluating the impact of image guidance in the surgical setting: a systematic review." *Surgical endoscopy* 33 (2019): 2785-2793.
8. Verma, A., & Nair, R. (2025). Chromatographic Methods for the Separation of Naturally Occurring Bioactive Compounds and Their Applications in Industry. *Engineering Perspectives in Filtration and Separation*, *3*(1), 18-24.
9. Jannin, Pierre, and Werner Korb. "Assessment of image-guided interventions." In *Image-guided interventions: technology and applications*, pp. 531-549. Boston, MA: Springer US, 2008.
10. Mehta, P., & Malhotra, K. (2024). Natural Language Processing for Automated Extraction of Medical Terms in Electronic Health Records. *Global Journal of Medical Terminology Research and Informatics*, *2*(2), 1-4
11. Vosburgh, Kirby G., and Ferenc A. Jolesz. "The concept of image-guided therapy." *Academic Radiology* 10, no. 2 (2003): 176-178.
12. Al-Jizani, H. N. Z., &Kayabaş, A. (2023). Students Real Data Features Analyzing with Supervised Learning Algorithms to Predict Efficiency. *International Journal of Advances in Engineering and Emerging Technology*, *14*(1), 34–45
13. Jannin, Pierre, and Werner Korb. "Assessment of image-guided interventions." In *Image-guided interventions: technology and applications*, pp. 531-549. Boston, MA: Springer US, 2008.
14. Alexander, Harry C., Scott JP Mclaughlin, Robert H. Thomas, and Alan F. Merry. "Checklists for image-guided interventions: a systematic review." *The British Journal of Radiology* 94, no. 1121 (2021): 20200980.
15. Bujold, Alexis, Tim Craig, David Jaffray, and Laura A. Dawson. "Image-guided radiotherapy: has it influenced patient outcomes?." In *Seminars in radiation oncology*, vol. 22, no. 1, pp. 50-61. WB Saunders, 2012
16. Dilley, James, Mafalda Camara, Ismail Omar, Alex Carter, Philip Pratt, Justin Vale, Ara Darzi, and Erik K. Mayer. "Evaluating the impact of image guidance in the surgical setting: a systematic review." *Surgical endoscopy* 33 (2019): 2785-2793.
17. Botla, A., Kanaka Durga, G., &Paidimarry, C. (2024). Development of Low Power GNSS Correlator in Zynq SoC for GPS and GLONSS. Journal of VLSI Circuits and Systems, 6(2), 14–22. https://doi.org/10.31838/jvcs/06.02.02
18. Hoa, N. T., &Voznak, M. (2025). Critical review on understanding cyber security threats. Innovative Reviews in Engineering and Science, 2(2), 17-24. https://doi.org/10.31838/INES/02.02.03
19. Sadulla, S. (2024). Techniques and applications for adaptive resource management in reconfigurable computing. SCCTS Transactions on Reconfigurable Computing, 1(1), 6-10. https://doi.org/10.31838/RCC/01.01.02
20. Muralidharan, J. (2024). Machine learning techniques for anomaly detection in smart IoT sensor networks. Journal of Wireless Sensor Networks and IoT, 1(1), 15-22. https://doi.org/10.31838/WSNIOT/01.01.03

21. Sadulla, S. (2024). A comparative study of antenna design strategies for millimeter-wave wireless communication. SCCTS Journal of Embedded Systems Design and Applications, 1(1), 13-18. https://doi.org/10.31838/ESA/01.01.03
22. Sadulla, S. (2024). Next-generation semiconductor devices: Breakthroughs in materials and applications. Progress in Electronics and Communication Engineering, 1(1), 13–18. https://doi.org/10.31838/PECE/01.01.03
23. Khan, Z. (2024). Design of smart wearable for cardiopulmonary monitoring with adaptive feedback loop. Electronics, Communications, and Computing Summit, 2(4), 21–31.