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Image-Guided Drug Delivery Market - A Global and Regional Analysis: Focus on Technology Type, Application, End User, and Regional Analysis - Analysis and Forecast, 2025-2035

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Abstracts

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Introduction of Image-Guided Drug Delivery

Image-Guided Drug Delivery applies advanced, precision-driven, minimally invasive techniques to deliver therapeutics directly to targeted disease sites, including tumors and neurological regions. This innovative field represents a paradigm shift in modern medicine, moving beyond conventional systemic therapies toward safer, more localized, and patient-specific interventions. By combining specialized drug delivery systems such as catheters and cannulae with MRI, CT, and ultrasound-based imaging platforms, augmented by robotics and AI-driven navigation, image-guided drug delivery enables clinicians to administer gene therapies, chemotherapeutics, and cell-based treatments with exceptional accuracy and control. This approach improves therapeutic efficacy, minimizes systemic toxicity, shortens recovery times, and optimizes healthcare resources, positioning image-guided drug delivery as a cornerstone of next-generation precision medicine.

Market Introduction

The global image-guided drug delivery market is expected to witness significant growth, projected to reach $983.0 million by 2035, driven by the escalating global burden of cancer, neurological disorders, and other chronic diseases that demand safer, more precise, and less invasive therapeutic approaches. Anchored in catheter-based infusion

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systems, multiport cannulae, and image-guided navigation platforms, IGDD integrates advanced imaging, robotics, and AI to deliver localized therapies with superior accuracy, minimized systemic toxicity, and improved patient outcomes.

Image-guided drug delivery represents a paradigm shift in modern medicine, combining imaging precision, controlled infusion, and real-time monitoring to expand access to targeted therapies. Key milestones, such as the FDA De Novo clearance of ClearPoint Neuro's SmartFlow Cannula, the first U.S.-approved device for intracerebral gene therapy—and the commercial launch of TriSalus Life Sciences' TriNav FLX infusion system, have validated these disruptive approaches. Similarly, software-driven navigation platforms such as Koninklijke Philips' EmboGuide and GE HealthCare's FlightPlan for Liver underscore the move toward standardization and reproducibility in complex oncology and neurology procedures.

Market expansion is further supported by favorable regulatory and reimbursement frameworks in North America, Europe, and Japan, coupled with increasing investments from the public and private sectors in hybrid operating suites, imaging infrastructure, and training for interventional specialists. Countries across North America, Europe, and Asia-Pacific are scaling hospital capacity and fostering innovation hubs, while emerging markets such as India, Brazil, and Southeast Asia present untapped potential for growth as precision medicine adoption accelerates.

Technological convergence is a key accelerator, with innovations in AI-assisted infusion planning, MRI-compatible surgical robotics, and multimodal imaging enhancing both delivery accuracy and long-term therapeutic outcomes. While oncology remains the dominant application, neurology is rapidly expanding, particularly in gene and cell therapy delivery for conditions such as glioblastoma, Parkinson's disease, and AADC deficiency. Broader applications in gastrointestinal and cardiovascular disorders are also beginning to extend the scope of image-guided drug delivery technologies.

Despite strong momentum, challenges such as high acquisition costs, workflow integration barriers, and uneven access in low- and middle-income regions remain. However, growing payer support, coupled with industry–academic–biopharma collaborations, is steadily overcoming these hurdles by accelerating clinical validation and lowering barriers to adoption.

Leading players such as ClearPoint Neuro, Inc., TriSalus Life Sciences, Inc., RenovoRx, Koninklijke Philips N.V., GE HealthCare, and AiM Medical Robotics are shaping the competitive landscape, advancing first-in-class devices, building robust

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clinical evidence, and pursuing commercialization strategies across oncology and neurology. As healthcare increasingly emphasizes precision medicine, minimally invasive delivery, and patient-centric care, image-guided drug delivery is positioned at the forefront of therapeutic innovation, set to redefine treatment paradigms and improve outcomes for patients worldwide.

Industrial Impact

Image-guided drug delivery is reshaping therapeutic care in oncology and neurology by enabling minimally invasive, precision-guided administration of advanced treatments. Catheter-based infusion platforms such as ClearPoint Neuro's SmartFlow Cannula and TriSalus Life Sciences' TriNav FLX have redefined procedural accuracy, allowing direct drug and gene therapy delivery into targeted brain regions or solid tumors. By overcoming barriers such as the blood–brain barrier and ensuring localized drug penetration, IGDD technologies are improving efficacy, reducing systemic toxicity, and minimizing hospital stays—positioning them as critical enablers of next-generation personalized medicine.

Beyond individual procedures, image-guided drug delivery is fostering innovation across procedural ecosystems and clinical workflows. Integration of MRI/CT-guided navigation platforms ,robotic systems, and AI-assisted infusion planning tools is standardizing drug placement, enabling real-time therapy monitoring, and expanding treatment options for hard-to-reach tumors and CNS disorders. These platforms streamline clinical decision-making, reduce procedural variability, and make therapies more reproducible across institutions.

Simultaneously, strategic collaborations between device innovators, pharmaceutical companies, and academic research centers are accelerating the adoption of image-guided drug delivery in cell and gene therapy trials, with >60 biopharma partners already leveraging ClearPoint Neuro's systems for CNS-targeted delivery. Supportive regulatory pathways, such as the FDA's De Novo clearance of SmartFlow and EU MDR certifications, coupled with increasing reimbursement for precision infusion procedures, are driving commercial momentum.

At a system-wide level, Image-guided drug delivery is enhancing healthcare resilience by broadening access to advanced therapies, particularly in tertiary-care hospitals and cancer centers. Investments in hybrid ORs, neuro-interventional suites, and digital imaging infrastructure are enabling scalability of these technologies, while partnerships with global leaders such as Koninklijke Philips N.V., GE HealthCare, and innovative

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biotech firms are pushing IGDD toward mainstream adoption. Collectively, these advancements are redefining treatment delivery, improving patient outcomes, and strengthening the foundations of precision therapy in oncology and neurology.

Market Segmentation:

Segmentation 1: By Technology Type

Drug-Delivery Systems

Image-Guided Platforms

Drug-Delivery Systems (DDS) remain the leading segment by technology type in the global image-guided drug delivery market, holding 71.79% market share in 2024, with a projected CAGR of 30.87% during 2025-2035. Key subsegmentssuch as cannulae, multiport catheters, and pressure-enabled infusion systems drive the largest contributions due to their direct therapeutic role, proven clinical utility, and ability to overcome challenges such as the blood–brain barrier or intratumoral drug penetration. DDS dominate because of their essential role in enabling targeted delivery of advanced therapies, higher efficacy, and wider adoption in both oncology and neurology trials.

In contrast, Image-Guided Platforms including ClearPoint Navigation, Philips EmboGuide, and GE FlightPlan for Liver are growing rapidly as they improve feeder-vessel detection, enhance targeting accuracy, and standardize procedures. While smaller today, IGPs are expected to capture increasing share as clinical workflows demand greater imaging integration.

Segmentation 2: By Application

Oncology

Neurology

Others

Based on application, the global image-guided drug delivery market was led by the Oncology segment, which accounted for 76.44% share in 2024. Oncology is projected

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to maintain dominance through 2035 due to the rising global cancer burden and the demand for precision therapies in hepatic, pancreatic, and head & neck cancers. Intra-arterial infusion platforms and embolization software have demonstrated the ability to improve local drug concentration by up to 100? compared to IV routes, reducing systemic side effects and reinforcing oncology as the primary growth driver. Neurology is the fastest-growing segment, supported by FDA and CE-cleared technologies such as SmartFlow Cannula, neuroinfuse, and multiport catheters that enable targeted CNS delivery for conditions like glioblastoma, Parkinson's, and AADC deficiency.

Segmentation 3: By End User

- Hospitals
- Pharmaceutical & Biotechnology Companies
- Contract Research Organizations (CROs)
- Research Institutes & Universities

Based on end user, the global image-guided drug delivery market was led by the Hospitals segment, which held a 91.30% share in 2024. Hospitals remain the primary hubs for IGDD adoption, equipped with hybrid operating suites, advanced imaging modalities, and specialized neurosurgical and oncology teams. Their ability to perform high-volume, complex procedures such as intracranial infusions and liver-directed oncology therapies supports their dominance, with adoption expected to grow as more next-generation therapies enter clinical practice.

Segmentation 4: By Region

- North America
  - U.S.
  - Canada
- Europe
  - Germany

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U.K.

France

Italy

Spain

Rest-of-Europe

Asia-Pacific

Japan

India

China

Australia

South Korea

Rest-of-Asia-Pacific

Rest-of-the-World

The Image-Guided Drug Delivery market in the Asia-Pacific region is expanding, led by China's high disease burden, domestic innovation, and growing imaging infrastructure. Japan and South Korea drive adoption through strong insurance support and advanced oncology and neurology centers, while India's vast, underpenetrated market is gaining momentum with rising demand and local innovation. Australia benefits from strong reimbursement and private adoption, whereas Singapore, Hong Kong, and Malaysia offer niche urban opportunities. In contrast, Indonesia, Vietnam, and the Philippines face infrastructure and funding challenges. Overall, growth in APAC hinges on innovation, affordability, and equitable access.

Recent Developments in the Image-Guided Drug Delivery Market

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In August 2025, ClearPoint Neuro, Inc. reported the first-ever commercial delivery of KEBILIDI (AADC deficiency gene therapy) in the U.S. using its FDA-authorized SmartFlow Neuro Cannula, marking a pivotal step in clinical implementation.

In June 2025, TriSalus Life Sciences, Inc. rolled out the TriNavFLX Infusion System, a new addition to its Pressure Enabled Drug Delivery (PEDD) line. The system's distal end is twice as long and more flexible than previous models, enabling smooth navigation through tortuous vessels. In benchtop testing, it reduced navigation force by 28% compared to the standard TriNav.

In May 2025, ClearPoint Neuro, Inc. entered into a structured financing agreement with Oberland Capital for up to $110 million, including note financing and equity components.

In April 2025, Johns Hopkins Medicine joined RenovoRx's TIGeR-PaC trial, enrolling patients with locally advanced pancreatic cancer (LAPC). The trial evaluates RenovoRx's intra-arterial gemcitabine (IAG) delivery via the RenovoCath device, comparing it to standard intravenous chemotherapy. This addition strengthens the trial, aiming for full enrollment by 2025.

In April 2025, ClearPoint Neuro, Inc. released ClearPoint Navigation Software Version 3.0, the first full end-to-end ClearPoint navigation solution specifically designed for standard operating rooms. It introduces a new iCT-guided workflow, enabling high-precision brain navigation without requiring MRI infrastructure.

Demand – Drivers, Challenges, and Opportunities

Market Demand Drivers:

Increased Demand for Personalized Medicine

The growing demand for personalized medicine is rapidly driving the evolution of the image-guided drug delivery market, as it emphasizes the necessity for precise, targeted therapies tailored to individual patient profiles. In fields such as oncology and neurology, personalized medicine seeks to adapt treatments based on genetic and disease-specific

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characteristics, ensuring the most effective outcomes with minimal side effects. Image-guided drug delivery technologies play a pivotal role in this transformation by enabling accurate, localized targeting of medications to specific body regions, thereby enhancing the precision of therapeutic interventions. A 2024 study published in Pharmacological Research, titled 'Biologics, Theranostics, and Personalized Medicine in Drug Delivery Systems,' underscored the role of image-guided drug delivery in the realm of theranostics, a critical component of personalized medicine. This approach utilizes advanced imaging technologies to precisely direct and monitor therapeutics, ensuring accurate drug localization at targeted disease sites.

By minimizing off-target effects, this technique significantly enhances therapeutic outcomes. Moreover, the ability to adjust treatment in real-time optimizes drug delivery, ensuring that the right dosage reaches the right location. This precision is especially impactful in areas such as prostate cancer and neurodegenerative diseases, where accurate drug targeting can markedly improve patient outcomes.Some of the other driving factors include:

Rising Prevalence of Chronic Diseases

Note: All of the above factors will be evaluated in detail in the report.

Market Restraints:

High Acquisition Cost of the Instruments

The high cost of equipment for image-guided drug delivery presents a substantial barrier to the widespread adoption and market growth of this innovative technology, especially in low- and middle-income countries. These systems rely heavily on advanced imaging technologies such as MRI, CT, and fluoroscopy, which are essential for precise navigation during surgeries and drug delivery. However, the financial burden of these technologies is considerable. For instance, MRI machines can cost between $130,000 and $700,000, with additional ongoing expenses for maintenance, software updates, and specialized personnel training. The combination of these high upfront costs and continuous operational expenses creates a significant hurdle for hospitals, particularly in resource-constrained settings, making it difficult to justify the investment when healthcare budgets are limited.

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As a result, this financial barrier not only limits the adoption of image-guided drug delivery systems in clinical environments but also hinders the overall expansion of the market. Smaller healthcare providers in emerging economies, where budgets are stretched thin, often cannot afford to invest in such technology, which may be perceived as non-essential in comparison to other immediate healthcare needs. This leads to a concentration of image-guided drug delivery technology in a small number of well-funded hospitals, restricting its broader application and diminishing its potential impact on patient care in underserved regions. Consequently, patients in these areas miss out on the benefits of more precise, targeted drug delivery, which is particularly valuable in cancer treatment and other specialized medical procedures requiring high levels of accuracy.

Market Opportunities:

Integration of Artificial Intelligence in Image-Guided Drug Delivery

The integration of Artificial Intelligence (AI) with image-guided drug delivery systems has emerged as a transformative advancement in cancer therapy, offering promising improvements in the accuracy, precision, and efficiency of drug delivery and monitoring. AI accelerates the process of image analysis, enabling the identification of subtle patterns within medical scans that optimize drug delivery to tumor sites. This innovation allows clinicians to target tumors with unprecedented precision, ensuring that the right amount of drug reaches the tumor while minimizing exposure to healthy tissue. Real-time monitoring, a critical component of personalized cancer care, is significantly enhanced through AI's ability to continuously track the behavior of drugs and nanoparticles within the body. AI algorithms monitor drug distribution and adjust the delivery process dynamically, ensuring better targeting of tumor cells. By providing this level of monitoring, AI contributes to improved treatment precision and outcomes, offering clinicians the tools necessary for more informed decision-making. AI's impact extends beyond the enhancement of imaging and monitoring to the personalization of treatment plans.

Market Trends:

Integration of Imaging with Targeted Drug Delivery

The integration of imaging with targeted drug delivery is a pivotal trend in modern medicine, fundamentally reshaping therapeutic approaches in both neurology and

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oncology. This paradigm shift is driven by a convergence of key developments, including significant regulatory milestones, growing clinical adoption, the launch of innovative new devices, and robust market momentum. This convergence is profoundly impacting the image-guided drug delivery market, transforming it from a niche, research-focused field into a rapidly expanding sector for mainstream clinical applications. This shift is fueled by the FDA's De Novo clearance of devices such as ClearPoint Neuro's SmartFlow Neuro Cannula, which validates a clear regulatory pathway for similar technologies, thereby reducing risk for investors and accelerating commercialization. On a clinical level, the use of real-time imaging and specialized catheters allows for unprecedented precision, ensuring a higher concentration of the therapeutic agent reaches the target site while sparing healthy tissue.

This not only improves treatment efficacy and reduces toxicity but also creates standardized, repeatable workflows that are more efficient and cost-effective for hospitals. The market is seeing a surge of new, purpose-built devices such as RenovoRx's RenovoCath and TriSalus Life Sciences' TriNav FLX, which are driving high-growth segments in targeted oncology and CNS delivery. Ultimately, the convergence of specialized delivery devices and image-guided navigation is creating a new standard of care, leading to reduced complications, higher procedure volumes, and improved patient outcomes in these critical therapeutic areas.

How can this report add value to an organization?

Product/Innovation Strategy: The report offers in-depth insights into the latest technological advancements in Image-Guided Drug Delivery, enabling organizations to drive innovation and develop cutting-edge products tailored to market needs.

Growth/Marketing Strategy: By providing comprehensive market analysis and identifying key growth opportunities, the report equips organizations with the knowledge to craft targeted marketing strategies and expand their market presence effectively.

Competitive Strategy: The report includes a thorough competitive landscape analysis, helping organizations understand their competitors' strengths and weaknesses and allowing them to strategize effectively to gain a competitive edge in the market.

Regulatory and Compliance Strategy: It provides updates on evolving regulatory frameworks, approvals, and industry guidelines, ensuring organizations stay compliant and accelerate market entry for new Image-Guided Drug Delivery

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Investment and Business Expansion Strategy: By analyzing market trends, funding patterns, and partnership opportunities, the report assists organizations in making informed investment decisions and identifying potential M&A opportunities for business growth.

Methodology

Key Considerations and Assumptions in Market Engineering and Validation

The base year considered for the calculation of the market size is 2024. A historical year analysis has been done for the period FY2023. The market size has been estimated for FY2024 and projected for the period FY2025-FY2035.

The scope of this report has been carefully derived based on extensive interactions with experts and stakeholders across leading companies and research institutions worldwide. This report provides a comprehensive market analysis of robotics and non-robotics within the Image-Guided Drug Delivery market.

Revenues of the companies have been referenced from their annual reports for FY2023 and FY2024. For private companies, revenues have been estimated based on factors such as inputs obtained from primary research, funding history, market collaborations, and operational history.

The market has been mapped based on the available Image-Guided Drug Delivery products. All the key companies with significant offerings in this field have been considered and profiled in this report.

Primary Research:

The primary sources involve industry experts in Image-Guided Drug Delivery, including the market players offering products and services. Resources such as CEOs, vice presidents, marketing directors, and technology and innovation directors have been interviewed to obtain and verify both qualitative and quantitative aspects of this research study.

The key data points taken from the primary sources include:

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- Validation and triangulation of all the numbers and graphs
- Validation of the report’s segmentation and key qualitative findings
- Understanding the competitive landscape and business model
- Current and proposed production values of a product by market players
- Validation of the numbers of the different segments of the market in focus
- Percentage split of individual markets for regional analysis

Secondary Research

Open Sources

- Certified publications, articles from recognized authors, white papers, directories, and major databases, among others
- Annual reports, SEC filings, and investor presentations of the leading market players
- Company websites and detailed study of their product portfolio
- Gold standard magazines, journals, white papers, press releases, and news articles
- Paid databases

The key data points taken from the secondary sources include:

- Segmentations and percentage shares
- Data for market value
- Key industry trends of the top players of the market

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Qualitative insights into various aspects of the market, key trends, and emerging areas of innovation

Quantitative data for mathematical and statistical calculations

Key Market Players and Competition Synopsis

Profiled companies have been selected based on inputs gathered from primary experts, as well as analyzing company coverage, product portfolio, and market penetration.

Key players in the image-guided drug delivery market include global medical device and imaging companies offering a broad range of drug delivery systems and image-guided platforms for oncology and neurology. Established firms such as ClearPoint Neuro, Inc., Koninklijke Philips N.V., and GE HealthCare dominate with portfolios spanning MRI-guided navigation, infusion cannulae, and vessel-mapping software integrated into interventional oncology and CNS therapies.

Innovators are developing multiport catheters, pressure-enabled infusion systems, and AI-assisted navigation software to improve delivery accuracy and therapeutic outcomes. Companies like TriSalus Life Sciences and RenovoRx are pioneering catheter-based oncology platforms, while AiM Medical Robotics and others are advancing MRI-compatible surgical robots for neurosurgical delivery. Emerging players, including Neurochase and Infuseon Therapeutics, are introducing novel convection-enhanced delivery systems for direct brain infusion.

Start-ups and regional firms are also contributing with cost-effective infusion technologies, portable navigation tools, and specialized drug-device combinations targeting unmet needs in emerging markets. Collectively, these companies are driving innovation, expanding clinical access, and establishing image-guided drug delivery as a cornerstone of precision-guided, minimally invasive therapeutic delivery.

Some prominent names established in this market are:

ClearPoint Neuro, Inc.

TriSalus Life Sciences, Inc.

GE Healthcare

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Koninklijke Philips N.V.

RenovoRx Inc.

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