Scientific Resources

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Contents

Clinical Publication – 1

1) Robot-assisted CT-guided cryoablation of pulmonary metastases: an IDEAL stage 2a prospective development study

Nicos Fotiadis1,2*, Sajjan KC1, Shaira Farooq1, Jodie Basso1, David Cunningham3,4, Dow-Mu Koh2,5,

S. Nahum Goldberg6,7 and Edward W. Johnston1,2*

Interventional Radiology, Royal Marsden Hospital, London

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Objective

To evaluate the feasibility, safety, and technical performance of robot-assisted CT-guided cryoablation for pulmonary metastases.

Results

Robotic guidance was successfully completed without conversion in 35/37 tumours (95%). One major complication occurred (3%, CTCAE grade 3 pneumothorax requiring 4 days of drainage); all others were grade 1–2. Pneumothoraces were managed by observation (n =7) or prophylactic intraprocedural chest drain insertion (n = 11). No bronchopleural fistulas were observed. Median hospital stay was 1 night (IQR 1–2). A total of 54 cryoprobes were used. Median Euclidean targeting error on first insertion was 6.1mm (IQR 2.9–9.7) and lateral error 4.2mm (IQR 2.2–6.5). The median number of manipulations per probe was 1 (IQR 0–2.5), with one-third requiring no adjustment. Once integrated into the workflow, the "chopstick" technique was frequently applied, supporting conformal ablation. Median total procedure time was 66.5 min (IQR 56.6–92.8). Twelve-month local tumour progression-free survival was 97%.

Conclusion

Robotic guidance offers particular advantages for cryoablation, enabling accurate and reproducible multiprobe configurations for conformal ice-ball formation with minimal manipulation. Using robotic CT guidance, we successfully performed cryoablation of subpleural pulmonary metastases, demonstrating feasibility, safety, and accuracy in technically complex cases. These findings suggest robotics may expand the treatable case spectrum and support a multicentre trial comparing robotic and freehand cryoablation.

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Clinical Publication – 2

2) PET/CT-Guided Biopsy in Necrotic Lung Mass: A Diagnostic Breakthrough

Anurag Jain, Kunal Kumar1 , Divya Gupta2 , Vikrant Balaan3 , Neeraj Kumar4 , Madan Gopal Vishnoi4 , Abhishek Mahato

Department of Nuclear Medicine, Command Hospital, Lucknow, Uttar Pradesh, India

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Objective

A 60-year-old man who never smoked presented with a 2-month history of dull, poorly localized right-sided chest pain and a dry cough. He also reported a loss of appetite and unintentional weight loss. On clinical examination, he was hemodynamically stable, with clear breath sounds bilaterally. His hemogram and biochemical parameters were within normal limits, and electrocardiography showed a normal sinus rhythm. A posteroanterior chest radiograph revealed a suspicious mass lesion in the right upper zone. Contrast-enhanced computed tomography (CT) of the chest demonstrated a 70 mm × 40 mm × 61 mm spiculated , heterogeneously enhancing soft-tissue lesion in the apical segment of the right upper lobe. Whole-body 18F-fluorodeoxyglucose positron/emission tomography (FDG PET) showed avid uptake in the lesion (maximum standardized uptake value, 8.4), suggesting high metabolic activity consistent with malignancy. Radial endobronchial ultrasound (EBUS)-guided transbronchial lung biopsy was performed. Fiberoptic bronchoscopy showed no visible endobronchial growth. Biopsy specimens obtained under radial EBUS guidance yielded inconclusive histopathologic findings. A follow-up CT- guided percutaneous biopsy of the mass demonstrated necrotic material only, without viable tumor cells. The imaging features and metabolic activity were strongly suggestive of malignancy, yet repeated biopsy attempts failed to yield diagnostic tissue. The case underscores the diagnostic difficulty in sampling centrally necrotic tumors and the need for integrating imaging with clinical and histologic correlation.

Conclusion

Several studies have highlighted the diagnostic challenges in obtaining representative tissue from centrally necrotic or metabolically heterogeneous lung tumors. In such cases, conventional biopsy methods such as CT-guided percutaneous biopsy or transbronchial lung biopsy often yield necrotic or nondiagnostic material, as observed in our patient.[1,2] FDG PET/CT has been reported to play a pivotal role in guiding biopsies by identifying the most metabolically active viable tumor regions, thereby improving diagnostic yield.[3,4] Unlike previous reports that mainly describe FDG PET-/ CT-assisted localization followed by CT-guided biopsy, our case demonstrates the successful application of robot-assisted FDG PET-/CT-guided biopsy, which allowed precise sampling of the metabolically active portion of the lesion and ultimately established the diagnosis of lung adenocarcinoma.

https://doi.org/10.4103/ijnm.ijnm_66_25

3) Imaging Characteristics of Pulmonary Metastases on Computed Tomography and Outcomes of Radiofrequency Ablation for Local Treatment of Pulmonary Metastases Under Robot Maxio Guidance

Đinh Gia Khánh*, Hoàng Ngọc Hạnh*, Nguyễn Minh Huệ*, Bùi Hoàng Duy*, Nguyễn Duy Hải*, Đinh Quang Linh*, Trần Bá Tú**

108 Hospital, Hanoi, Vietnam

Accepted: 4 SEPTEMBER 2025

Objective

To characterize the imaging features of pulmonary metastases on computed tomography (CT) and to evaluate the outcomes of radiofrequency ablation (RFA) for local treatment of pulmonary metastases using Maxio robot guidance.

Results:

Most patients presented with multiple metastatic nodules rather than solitary ones. The most common sites were the right upper lobe and the lower lobes of both lungs. The mean tumor diameter was 25 ± 4.5 mm. The majority of lesions were solid nodules (86.7%). Radiofrequency ablation (RFA) was performed once in 19 patients, twice in 7 patients, and three times in 4 patients. The disease control rate reached 86.7%, with tumor necrosis observed at 6 months. One case of life-threatening massive hemoptysis was recorded.

Conclusion

Pulmonary metastatic lesions typically present as multiple, solid nodules, commonly located in the lower lobes of both lungs and the right upper lobe. Radiofrequency ablation of pulmonary metastases under Maxio robotic guidance demonstrated favourable initial efficacy with a low complication rate.

https://vjol.info.vn/index.php/tchoidienquangvayhochatnhan/article/download/119739/99638/

4) Efficacy and safety of [18F]NaF PET/CT guided intraarticular block for lumbar facet joint and sacroiliac joint arthropathy: a single-arm phase 2 trial

Rajender Kumar1 · Venkata Subramanian Krishnaraju1 · Vishal Kumar2 · Bhagwant Rai Mittal1 · Avanthiga Subrhamanian1 · Babita Ghai3 · Harmandeep Singh1 · Sarvdeep Singh Dhatt2 · Anish Bhattacharya1

Department of Nuclear Medicine Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, India

Received: 3 May 2025 / Accepted: 4 August 2025

Objective:

To evaluate the efficacy and safety of robotic-arm-assisted [18F]NaF-PET/CT-guided intra-articular block for lum- bar facet joint (LFJ) or sacroiliac joint (SIJ) arthropathy.

Results

Out of 85 enrolled participants, 79 (92.9%) underwent [18F]NaF-PET/CT. Among them, 61 (77.2%) had NaF-avid joints, and 55(69.6%) underwent PET/CT-guided robotic-arm-assisted intra-articular blocks. The primary end-point was met in 84% (46/55) participants, and secondary end-points in 96% (53/55) and 89% (49/55), respectively. The procedure was technically successful in all the target joints. A significant change in pre- and post-procedural median SUVmax and SUV-peak of the treated joints was noticed. No major adverse effects were noticed in the participants.

Robotic-arm-assisted [18F]NaF-PET/CT guided intra-articular blocks of LFJ and SIJ in CLBP appear to be safe and feasible in NaF-avid arthropathy. However, lack of comparison with the standard of care, small sample size, selection bias and radiation exposure limit its generalizability.

Conclusion

Robotic-arm-assisted [18F]NaF-PET/CT guided intra-articular blocks of LFJ and SIJ in CLBP appear to be safe and feasible in NaF-avid arthropathy. However, lack of comparison with the standard of care, small sample size, selection bias and radiation exposure limit its generalizability.

https://doi.org/10.1007/s00259-025-07516-4

5) Single-room transcatheter CT hepatic angiography for microwave liver ablation: a feasibility and safety study

Edward W Johnston, PhD�,1,2 , Jodie Basso, BSc1 , Shaira Farooq, BSc1 , Ed McDonagh, MSc2,3 , Louise Giansante, MSc3 , David Cunningham, MD4,5 , Dow-Mu Koh, MD2,6 , Martijn Meijerink, MD, PhD7 , Nicos Fotiadis, MD, PhD1,2

Royal Marsden Hospital, London

Received: 16 October 2024; Revised: 21 November 2024; Accepted: 21 May 2025

Objective

Transcatheter CT hepatic angiography (CTHA) enhances liver tumour ablation by enabling multiple direct intra-arterial contrast injections during a single procedure. We report the implementation of a single-room CTHA workflow using a mobile fluoroscopic C-arm, focusing on feasibility and safety.

Results

Twenty patients (14 men, median age 66 years) underwent 21 CTHA procedures (April–September 2024). Feasibility and technical success were 100%, without any instance of CTHA-related complications. Median catheterization time was 10 min16 s, contrast dose was 174 mL (7 acquisitions), and radiation dose-area product was 18.86 Gy·cm2. Ninety-seven percent of tumours (32/33) were visible. All these tumours were completely covered by an ablation zone using image fusion software.

Conclusions:

Single-room CTHA using a mobile C-arm is feasible and safe for liver tumour ablation. This technique enhances tumour and ablation zone visibility whilst requiring low contrast volumes, enabling multiple acquisitions and real-time margin assessment. Our technique can be readily implemented without expensive infrastructure, holding significant promise in improving liver ablation outcomes and broadening access to advanced interventional oncology techniques.

https://doi.org/10.1093/bjr/tqaf117

6) The initial results of radiofrequency ablation for treating lung metastasis under computed tomography and Maxio robot guidance

Đinh Gia Khánh*, Nguyễn Văn Tuấn (D),Ngô Duy Đông, Nguyễn Văn Vượng,Quách Trung Nguyên và Nguyễn Minh Đức

108 Hospital, Hanoi, Vietnam

Received i: 19/6/2024, Accepted : 25/10/2024

Objective:

To evaluate the response to lung metastasis lesions treated with radiofrequency ablation and record complications of the above technique. Subject and method: A prospective and retrospective descriptive study of 25 patients with radiofrequency ablation of lung metastases under the guidance of computed tomography and Maxio robot from June 2018 to December 2023 at the 108 Military Central Hospital. Result: Mean age was 45.5 ± 8.7 years. The average tumor diameter was 25 ± 4.5mm. 23/25 patients were able to control the disease, the tumor necrosis after 6 months, 14/25 cases required a second additional burn, 01 case of life-threatening massive hemoptysis.

Conclusion:

Radiofrequency ablation of lung metastases under the guidance of computed tomography and Maxio robot has good initial results, with few complications.

https://tcydls108.benhvien108.vn/index.php/YDLS/article/view/2493/2203

7) Diagnostic Accuracy of PSMA PET-Guided Prostate Biopsy in Prostate Cancer—A Systematic Review and Meta-analysis

Piyush Aggarwal, MD, DNB,* Vinisha Gunasekaran, MD,* Harmandeep Singh, MD,*
Rajender Kumar, MD,* Swayamjeet Satapathy, MD, DM,† and Bhagwant Rai Mittal, MD, DNB*

Wolters Kluwer Health, Inc

Received: 30 July 2024 / Revised: 9 Aug 2024 / Accepted: 9 Oct 2024

Objective:

Early diagnosis and treatment of prostate cancer (PC) are crucial for effective management and improved patient outcomes. Newer imaging modalities like prostate-specific membrane antigen PET have shown superior diagnostic performance in detecting PC and clinically significant PC (csPC). This systematic review and meta-analysis aims to synthesize evidence on the diagnostic performance of PSMA PET-guided prostate biopsy in detecting PC and csPC.

Results

Out of 378 articles, 20 were assessed for full-text screening and 10 articles with 874 patients were finally included. Eight studies reported a pooled sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and diagnostic odds ratio of 0.90 (95%confidence interval [CI], 0.82–0.95), 0.93 (95% CI, 0.57–0.99), 12.3 (95% CI, 1.5–98.9), 0.10 (95% CI, 0.05–0.20), and 117 (95% CI, 12–1178), respectively, for detecting PC using PSMA PET-guided prostate biopsy with an area under the summary receiver operating characteristics curve of 0.94 (95% CI, 0.92–0.96). Similarly, 6 studies reported a pooled sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and diagnostic odds ratio of 0.89 (95% CI, 0.82–0.94), 0.65 (95% CI, 0.49–0.79), 2.6 (95% CI, 1.6–4.1), 0.17 (95% CI, 0.09–0.31), and 15 (95% CI, 6–41), respectively, for detecting csPC using PSMA PET-guided prostate biopsy with area under summary receiver operating characteristics curve of 0.86 (95% CI, 0.82–0.88).

Conclusion:

PSMA PET-guided prostate biopsy has a high diagnostic accuracy in detecting PC and csPC in patients with clinical suspicion of PC, and provides a 1-stop solution for early diagnosis and staging of PC.

http://dx.doi.org/10.1097/RLU.0000000000005501

8) Robotic-assisted CT-guided percutaneous pulmonary nodules localization by hook-wire needles: a retrospective observational study

The First Affiliated Hospital of Chongqing Medical University, Chongqing, CHINA.
Haoming Guo, Zubin Ouyang, Xinghua Li, Yongliang Han, Fengming Tao, Mengqi Liu, Runtian Cheng, Xiaoya Chen, Fajin Lv, Haitao Yang

Department of Radiology, the First Affiliated Hospital of Chongqing Medical University, Chongqing, China

Published online Jul 04, 2024.

Objective:

Preoperative computed tomography (CT)-guided localization of small pulmonary nodules (SPNs) is the major approach for accurate intraoperative visualization in video-assisted thoracoscopic surgery (VATS). However, this interventional procedure has certain risks and may challenge to less experienced junior doctors. This study aims to evaluate the feasibility and efficacy of robotic-assisted CT-guided preoperative pulmonary nodules localization with the modified hook-wire needles before VATS. Methods: A total of 599 patients with 654 SPNs who preoperatively accepted robotic-assisted CT-guided percutaneous pulmonary localization were respectively enrolled and compared to 90 patients with 94 SPNs who underwent the conventional CT-guided manual localization. The clinical and imaging data including patients' basic information, pulmonary nodule features, location procedure findings, and operation time were analyzed. Results: The localization success rate was 96.64% (632/654). The mean time required for marking was 22.85±10.27 min. Anchor of dislodgement occurred in 2 cases (0.31%). Localization-related complications included pneumothorax in 163 cases (27.21%), parenchymal hemorrhage in 222 cases (33.94%), pleural reaction in 3 cases (0.50%), and intercostal vascular hemorrhage in 5 cases (0.83%). Localization and VATS were performed within 24 hours. All devices were successfully retrieved in VATS. Histopathological examination revealed 166 (25.38%) benign nodules and 488 (74.62%) malignant nodules. For patients who received localizations, VATS spent a significantly shorter time, especially the segmentectomy group (93.61±35.72 vs. 167.50±40.70 min, P<0.001). The proportion of pneumothorax in the robotic-assisted group significantly decreased compared with the conventional manual group (27.21% vs. 43.33%, P=0.002).

Conclusions:

Robotic-assisted CT-guided percutaneous pulmonary nodules hook-wire localization could
be effectively helpful for junior less experienced interventional physicians to master the procedure and potentially increase precision.

Robotic-assisted CT-guided percutaneous pulmonary nodules hook-wire localization could be effectively helpful for junior less experienced interventional physicians to master the procedure and potentially increase precision. In other words, robot techniques would be able to provide beginners more accurate and safe technology for interventional procedures.

https://doi.org/10.21037/jtd-24-198

9) Advances of surgical robotics: image-guided classification and application

Changsheng Li3,†, Gongzi Zhang1,†, Baoliang Zhao2,†, Dongsheng Xie3,4, Hailong Du1, Xingguang Duan3,4, Ying Hu2 and Lihai Zhang1,2,∗

Wolters 4School of Medical Technology, Beijing Institute of Technology, Beijing 100081, China

Received: 27 December 2023; Revised: 19 April 2024; Published: 6 June2024.

Objective:

Surgical robotics application in the field of minimally invasive surgery has developed rapidly and has been attracting increasingly more research attention in recent years. A common consensus has been reached that surgical procedures are to become less traumatic and with the implementation of more intelligence and higher autonomy, which is a serious challenge faced by the environmental sensing capabilities of robotic systems. One of the main sources of environmental information for robots are images, which are the basis of robot vision. In this review article, we divide clinical image into direct and indirect based on the object of information acquisition, and into continuous, intermittent continuous, and discontinuous according to the target-tracking frequency. The characteristics and applications of the existing surgical robots in each category are introduced based on these two dimensions. Our purpose in conducting this review was to analyze, summarize, and discuss the current evidence on the general rules on the application of image technologies for medical purposes. Our analysis gives insight and provides guidance conducive to the development of more advanced surgical robotics systems in the future.

Conclusion:

Surgical robots possess technical capabilities sur-passing those of humans, enabling precise operations with significant research and clinical application val-ues. However, the completion of these operations and the progress of intelligent surgery largely depend on the fine perception of the surgical en-vironment, especially the acquisition of images and the target-tracking method, making percep-tion a quite appropriate classification criterion. This paper summarizes the application of imagesvin surgical robotics and proposes a new category system dividing image application into two dimen-sions: direct/indirect and continuous/intermittent continuous/discontinuous. Here, we analyze the relationships and differences between the applica-tion mode and scenario for each category, aiming to provide a reference, guidance, and inspiration for future research on surgical robotics.

https://academic.oup.com/nsr/article/11/9/nwae186/7689225

10) Pathologic Validation of Deauville Score-Based Disease on F-18 FDG PET/CT after First-Line Treatment in Patients with Lymphoma

Rajender Kumar1 · Venkata Subramanian Krishnaraju1 · Bhagwant Rai Mittal1 · Kritin Shankar1 · Harmandeep Singh1 · Arivan Ramachandran1 · Anish Bhattacharya1 · Gaurav Prakash2 · Amanjit Bal3 Pankaj Malhotra2
Korean Society of Nuclear Medicine 2024

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Objective

PET/CT-based Deauville scoring (DS) is routinely used for lymphoma response assessment. However, pathological correlation of DS is not yet precisely documented. In the present study we aimed to pathological confirm the PET/CT based Deauville scoring (DS) in lymphoma after first-line chemotherapy.

Results

In all, 148/480 participants were PET-positive, and 332/480 were PET-negative. 138/148 PET-positive and 12/332 PET-negative lesions were recruited for biopsy. Biopsy was performed in 147/150 participants (PET-positive 135; PET-negative 12). Three patients with inaccessible lesions were excluded. The diagnostic yield of the procedure was 97.3% (143/147). Histology revealed lymphoma in 106 participants (including 70% of total DS-4, 100% of DS-5a and 73.9% of DS-5b lesions), with three false-negative lesions. DS ≤ 3 lesions were true-negative except one diagnosed with lymphoma (8.3%) on follow-up. Non-lymphomatous malignancies (n = 5), granulomas (n = 12), non-specific inflammation (n = 9) and no residual disease (n = 11) were diagnosed in the rest. No major procedure-related adverse event was noted.

Conclusion:

DS-5a lesion suggests residual disease; hence, a biopsy can be prevented unless Richter's transformation is suspected. DS-4 and DS-5b lesions require a biopsy before changing the treatment plan, as a certain number of participants had non-lymphomatous F-18 FDG-avid lesions.

https://doi.org/10.1007/s13139-024-00868-z

11) Review of robotic systems for thoracoabdominal puncture interventional surgery

Cheng Wang,1 Li Guo,1 Jianjun Zhu,1,2 Lifeng Zhu,3 Chichi Li,4 Haidong Zhu,2 Aiguo Song,3

Ligong Lu,5,6 Gao-Jun Teng,2,a) Nassir Navab,7,8 and Zhongliang Jiang7

Miami Cardiac and Vascular Institute, Miami, Florida

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Objective:

Cancer, with high morbidity and high mortality, is one of the major burdens threatening human health globally. Intervention procedures via percutaneous puncture have been widely used by physicians due to its minimally invasive surgical approach. However, traditional manual puncture intervention depends on personal experience and faces challenges in terms of precisely puncture, learning-curve, safety and efficacy. The development of puncture interventional surgery robotic (PISR) systems could alleviate the aforementioned problems to a certain extent. This paper attempts to review the current status and prospective of PISR systems for thoracic and abdominal application. In this review, the key technologies related to the robotics, including spatial registration, positioning navigation, puncture guidance feedback, respiratory motion compensation, and motion control, are discussed in detail.

Conclusion:

Robotic systems are renowned for their precision in spatial posi-tioning, high stability, dexterous maneuverability, and operational endurance. The integration of robotics with medical technology holds significant clinical value and represents a current direction of develop-ment in the field. In this review, we highlight commercialized PISR systems that are at the cutting edge of technology and advancements.Despite the remarkable capabilities of these robotic systems, they are not without their limitations and challenges, particularly in addressing the complexities of soft tissue deformation and the intricacies of patient respiratory movements. To pave the way for the next-generation of PISR systems, a concerted effort toward evolutionary advancements is necessary and several key directions could be consid-ered: 1. Enhanced multi-dimensional perception: future PISR systemsshould harness information across a spectrum of dimensions, not lim-ited to but including optical information, force feedback, positional insight, and visual cues. An integration approach to holistic informa-tion is essential for achieving a comprehensive understanding of the surgical environment. 2. Advanced information acquisition: the incor-poration of ultrasound technology into navigational systems, when synergized with AI or advanced LLM techniques, promises a leap in the robots' perceptual capabilities.

https://doi.org/10.1063/5.0180494

12) PET-CT guided robotic biopsies – An institutional experience

Abhishek Mahato, Anurag Jain, Richa Joshi, Vadlamani Suryaprakash, Rajesh Nair, Awadhesh Tiwari

Department of Nuclear Medicine, Command Hospital, Lucknow, Uttar Pradesh, India

Accepted: November 2023 - Volume 38 - Issue Supplement l 1

Objective:

Traditionally, USG and CT-guided biopsies have been the primary methods for obtaining tissue samples. CT guided biopsies are generally considered reliable, with reported accuracy rates ranging from 80% to over 98%. However, their success depends on various factors, including lesion location, type, operator expertise, sampling technique, and patient-related factors. Challenges arise when lesions are near critical structures or in complex anatomical regions. Different lesion types, such as solid masses and cystic structures, present varying levels of biopsy difficulty. Operator skill and experience significantly affect precision, as does the chosen sampling technique. Patient-related factors, such as body habitus, breathing patterns, and anatomical considerations, also impact procedural success and accuracy. Failed biopsies can result from various factors, preventing the acquisition of precise tissue samples. Sampling errors, where the biopsy may not fully represent the lesion or may miss the target entirely, can lead to incorrect diagnoses. Inadequate tissue samples, whether too small or fragmented, hinder accurate pathological assessment. Biopsy technique, including angles and pressure, influences sample quality, and tissue characteristics like location, texture, and consistency can be challenging. Operator expertise is crucial, as inexperienced practitioners may make errors during sample collection. Patient-specific factors like obesity or anatomical variations can complicate access to the target tissue. Complications such as bleeding, hematoma, or infections at the biopsy site can compromise sample quality. Tumor heterogeneity, where cells within a tumor vary, can yield inaccurate results if the sampled area lacks abnormal cell representation. Proper fixation and processing are vital for accurate diagnosis, as errors can degrade tissue and impede analysis. Technical limitations, especially for delicate or small tissues, make accurate biopsy challenging. Patient cooperation and positioning are essential to prevent errors caused by movement. Instrumentation issues, like malfunctioning tools, can lead to unsuccessful biopsies. Furthermore, previous treatments like radiation therapy or chemotherapy can modify tissue appearance, complicating accurate diagnoses. To mitigate the risk of failed biopsies and ensure reliable diagnostic outcomes, meticulous planning, skilled operators, and consideration of patient-specific variables are essential. This study was conducted to evaluate the benefits and limitations of PET-CT guided robotic biopsies at a tertiary care center.

Conclusion:

Robotic guided PET-CT biopsies are user friendly and aid medical professionals in adapting to its application, thereby reducing the learning curve. It offers navigation of needle through complex trajectories with reliable accuracy decreasing the procedure time and number of needle pass and check CT. By minimizing operator fatigue it enables consistent and reproducible results, Moreover it

streamlines the biopsy process, potentially reducing patient discomfort and recovery time. While robotic-guided biopsies offer numerous advantages, they also come with their own set of considerations; including equipment costs, training requirements, and the need for experienced operators. The decision to use robotic technology should be made based on a thorough evaluation of the specific clinical scenario and available resources.

https://journals.lww.com/ijnm/fulltext/2023/38001/abstracts.4.aspx

13) Optimisation of patient workflow for PET-CT guided robotic biopsies – Experience at a tertiary care center – A technologist perspective

Awadhesh Tiwari, Anurag Jain, Abhishek Mahato

Department of Nuclear Medicine, Command Hospital, Lucknow, Uttar Pradesh, India

Accepted: November 2023 - Volume 38 - Issue Supplement l 1

Objective:

Optimisation of patient workflow for PET-CT guided robotic biopsies – Experience at a tertiary care center – A technologist perspective. The optimization of patient workflow in PETCT guided robotic biopsy procedures is a critical aspect of improving the efficiency and efficacy of Nuclear Medicine. PET-CT-guided robotic biopsies have emerged as a precise and minimally invasive technique for obtaining tissue samples for diagnostic purposes. However, the success of these procedures depends not only on the accuracy of robotic systems but also on the seamless coordination of various components within the workflow. Also in a Nuclear Medicine department time is of essence due to decay of the radiopharmaceuticals and exposure of the healthcare staff performing the procedure. To optimize patient workflow, several crucial elements are addressed which can be categorised under three heads.

Conclusion:

Optimizing patient workflow in CT-guided robotic biopsy procedures contributes to reduced patient discomfort, shorter procedure times, and enhanced diagnostic accuracy. This not only benefits patients by improving their overall experience but also benefits healthcare providers by increasing the efficiency of interventional radiology services. Continuous refinement of workflow processes, coupled with advances in technology and training, will further improve the precision and accessibility of CT-guided robotic biopsies in the future.

https://journals.lww.com/ijnm/fulltext/2023/38001/abstracts.4.aspx

14) Lung biopsy -PET CT guided robot assisted procedures – An institutional experience

Anurag Jain, Abhishek Mahato, Awadesh Tiwari

Department of Nuclear Medicine, Command Hospital, Lucknow, Uttar Pradesh, India

Accepted: November 2023 - Volume 38 - Issue Supplement l 1

Objective:

Lung biopsies are categorized based on access method and the purpose of the biopsy itself. The Tru-Cut biopsy technique offers a straightforward, safe, swift, and dependable approach for diagnosing lung mass lesions, especially when coupled with Robot assisted positron emission tomography computed tomography (CT) scans technique. The introduction of positron emission tomography-computed tomography (PETCT) scans has significantly improved the staging and localization of cancer lesions. Combining this advanced imaging technology with robotic-assisted biopsy systems is a game-changer in the field. This method is a new cutting edge technique to identify various types of lung tumors and explore its efficacy in diagnosis. This study seeks to evaluate the diagnostic utility of the Tru-Cut biopsy in lung tumors with Robot assisted positron emission tomography computed tomography (CT) scans guided technique.

Conclusion:

Robot assisted positron emission tomography computed tomography CT-guided Tru-Cut biopsy emerges as a straightforward, secure, and dependable procedure, boasting substantial diagnostic accuracy for identifying and subtyping lung cancer. The definitive determination of malignancy stands as a critical factor in making well-informed decisions regarding patient treatment. This determination hinges on meticulous clinical correlation with the patient's performance status, radiological findings, and comprehensive serological investigations. The Robot-Assisted PET-CT Guided Biopsy integrates the capabilities of robotic platforms and PET-CT imaging to enhance the precision and accuracy. Robot-Assisted PET-CT Guided Biopsies represent a significant advancement in the field of prostate cancer diagnosis. This innovative approach offers improved accuracy, reduced complications, and enhanced cancer detection rates.

https://journals.lww.com/ijnm/fulltext/2023/38001/abstracts.4.aspx

15) Robotics in Interventional Oncology: The Next Frontier in Image-Guided Interventions

Oleksandra Kutsenko, MD; Govindarajan Narayanan, MD; Nicole Gentile, MS;

and Ripal Gandhi, MD, FSIR, FSVM

Published: 10 October 2023

Objective:

Minimally invasive percutaneous biopsy and ablation of tumors gained a pivotal role in cancer management of solid tumors and have been widely accepted for their clinical effectiveness and safety, replacing surgical interventions in eligible patients.1,2 Both procedures require an accurate needle placement to obtain sufficient tissue samples or achieve an adequate ablation zone. Success depends on physician experience, entailing a series of mental estimations of surface-to-target distance and needle angulations.3 Achieving necessary precision can be challenging depending on lesion visualization, location, proximity to pulsating or moving structures, and patient's work of breathing. In turn, this may mandate repetitive imaging with frequent needle adjustments, prolonged procedural time, increased exposure to radiation to the patient and operator, and increased intraprocedural risks of complications .

Conclusion:

IO has undergone significant advancements in per- cutaneous image-guided procedures, necessitating the development of tools that augment the workflow.Although precision in reaching the target, reduction inradiation exposure, and decrease in procedural learning curve seem to be the obvious benefits, some of these devices also play a significant role in the preprocedural planning and postprocedural evaluation of the abla-tion zone. Several robotic systems have been under development, and some have now reached availability for clinical and commercial use. Robotic-assisted abla-tions are no longer an experimental option and are now moving into the mainstream interventional radiology routine. These promising robotic systems represent areas for innovative care and research in IO and can help improve patient outcomes.

https://evtoday.com/articles/2023-oct/robotics-in-interventional-oncology-the-next-frontier-in-image-guided-interventions

16) Percutaneous liver interventions with robotic systems: a systematic review of available clinical solutions

Department of Radiology, Sorbonne University, Tenon Hospital, Paris, France

SYLVAIN GUINEBERT, MD, PhD, 3ELENA N. PETRE, MD, 3BRETT MARINELLI, MD, PhD, 3DEBKUMAR SARKAR, MD, 4MATTHIAS BARRAL, MD, PhD and 3,5FRANCOIS H CORNELIS, MD, PhD

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Objective

Robotic-guided interventions are emerging techniques that are gradually becoming a common tool for performing biopsies and tumor ablations in liver. This systematic review aims to evaluate their advancements, challenges, and outcomes.

Results

10 studies met the inclusion criteria. The robotic devices used included MAXIO, EPIONE, ROBIO-EX, AcuBot, and ACE robotic systems. The data set consisted of 429 percutaneous thermal ablations and 57 biopsies, both robot-guided. On average, the mean deviation of probes was reduced by 30% (from 1.6 vs 3.3 mm to 2.4 vs 3.9 mm ($p < 0.001$)), and 40% ($p < 0.05$) fewer read justments were required during the robotic-assisted interventions. Moreover, robotic systems contributed to a reduction in operating time, ranging from 15% (18.3 vs 21.7 min, $p < 0.001$) to 25% (63.5 vs 87.4 min, $p < 0.001$). Finally, the radiation dose delivered to both the patient and the operator was decreased by an average of 50% ($p < 0.05$) compared to manual procedures .

Conclusion

In conclusion, robotic systems may enhance the workflow of percutaneous interventions compared to manual procedures. They may offer improved accuracy in probe placement, reduced variability for probe positioning, and decreased radiation exposure for both patients and physicians.

https://doi.org/10.1259/bjr.20230620

17) Robotic versus freehand CT-guided radiofrequency ablation of pulmonary metastases: a comparative cohort study

Edward W. Johnston· Jodie Basso · Francisca Silva · Arafat Haris · Robin L. Jones · Nasir Khan. Helen Lawrence · Jakob Mathiszig-Lee· James McCall · David C. Cunningham · Nicos Fotiadis

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Objective:

Radiofrequency ablation (RFA) is a curative treatment option for small lung metastases, which conventionally involves multiple freehand manipulations until the treating electrode is satisfactorily positioned. Stereotactic and robotic guidance has been gaining popularity for liver ablation, although has not been established in lung ablation. The purpose of this study is to determine the feasibility, safety, and accuracy of robotic RFA for pulmonary metastases, and compare procedures with a conventional freehand cohort.

Conclusion:

Robotic radiofrequency ablation of pulmonary metastases with general anesthesia and high frequency jet ventilation is feasible and safe. Targeting accuracy is high, and fewer needle/electrode manipulations are required to achieve a satisfactory position for ablation than freehand placement, with early indications of reduced complications.
In summary, robotic radiofrequency ablation of pulmonary metastases with general anesthesia and high frequency jet ventilation is feasible and safe. Targeting accuracy is high, and fewer needle/electrode manipulations are required than freehand placement to achieve a satisfactory position for ablation, with early indications of reduced complications.

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18) Robot-Assisted Lung Biopsy: A Safer Approach to Lung Lesions

Shadab Maqsood1 Tahir Ahmad Khan1 Manzoor Hussain1 Mudasir Bhat1 Tahleel Altaf Shera1 Tariq Ahmad Gojwari1 Feroze A. Shaheen1

1Department of Radiology, Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Srinagar, Jammu and Kashmir, India

Purpose

This article evaluates the feasibility, safety, and technical success of robot-assisted computed tomography (CT)-guided percutaneous lung biopsy.

Results

All biopsies were successfully performed under CT guidance in both groups. Lesions size ($p = 0.39$), distance from entry point ($p = 0.78$), and lesions location ($p = 0.41$) were similar in both the groups. Full results of the homogeneity assessment of the two groups are given in [Table 1].

Table 1

Full results of the homogeneity assessment of the two groups

Parameters	**Group A**	**Group B**	***p*-Value**
Lesion size (mm)	33 ± 11 (range 20–110 mm)	29.5 ± 6.5 (range 22–98 mm)	0.39
Distance from entry point (mm)	65 ± 6.5 (range 23–109)	67 ± 5.6 (range 25–110)	0.78
Lesion location	RUL ($n = 3$) LUL ($n = 3$) RML ($n = 1$) RLL ($n = 13$) LLL ($n = 10$)	RUL ($n = 2$) LUL ($n = 2$) RML ($n = 1$) RLL ($n = 14$) LLL ($n = 11$)	0.41

Abbreviations: LLL, left lower lobe; LUL, left upper lobe; RLL, right lower lobe; RML, right middle lobe; RUL, right upper lobe.

In group A, the procedure duration was significantly shorter ($p = 0.001$), dose length product was lower ($p = 0.001$), and occasional needle adjustments were required as compared with group B. Planar and craniocaudal deviations of the needle tip from the planned target were less common in group A as compared with group B ($p = 0.003$). The diagnostic performance of CT-guided biopsies was similar in both the groups ($p = 0.05$), with two patients in group A and three patients in group B requiring repeat biopsy due to inadequate quality of the biopsy sample. The rate of major complications (such as hemothorax, pneumothorax) was higher in group B as compared with group A ($p = 0.002$)

Conclusion

Our study concluded that robot-guided lung biopsies are more successful in planning and safe targeting of lesions, with reduced procedure duration and radiation exposure, and decreased complications. Robotic system may reduce the dependence on the operator experience in performing CT-guided biopsies.

19) Comparison of a Robotic and Patient-Mounted Device for CT-Guided Needle Placement: A Phantom Study

Yannick Scharll, Alexander Mitteregger, Gregor Laimer, Christoph Schwabl, Peter Schullian and Reto Bale

Department of Radiology, Section of Interventional Oncology—Microinvasive Therapy (SIP), Medical University of Innsbruck, Anichstr. 35, 6020 Innsbruck, Austria

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Objective:

Robotic-based guidance systems are becoming increasingly capable of assisting in needle placement during interventional procedures. Despite these technical advances, less sophisticated low-cost guidance devices promise to enhance puncture accuracy compared with the traditional freehand technique. Purpose: To compare the in vitro accuracy and feasibility of two different aiming devices for computed-tomography (CT)-guided punctures. Methods: A total of 560 CT-guided punctures were performed by using either a robotic (Perfint Healthcare: Maxio) or a novel low-cost patient-mounted system (Medical Templates AG: Puncture Cube System [PCS]) for the placement of Kirschner wires in a plexiglass phantom with different slice thicknesses. Needle placement accuracy as well as procedural time were assessed. The Euclidean (ED) and normal distances (ND) were calculated at the entry and target point. Results: Using the robotic device, the ND at the target for 1.25 mm, 2.5 mm, 3.75 mm and 5 mm slice thickness were 1.28 mm (SD ± 0.79), 1.25 mm (SD ± 0.81), 1.35 mm (SD ± 1.00) and 1.35 mm (SD ± 1.03). Using the PCS, the ND at the target for 1 mm, 3 mm and 5 mm slices were 3.84 mm (SD ± 1.75), 4.41 mm (SD ± 2.31) and 4.41 mm (SD ± 2.11), respectively. With all comparable slice thicknesses, the robotic device was significantly more accurate compared to the low-cost device ($p < 0.001$). Needle placement with the PCS resulted in lower intervention time (mean, 158.83 s [SD ± 23.38] vs. 225.67 s [SD ± 17.2]). Conclusion: Although the robotic device provided more accurate results, both guidance systems showed acceptable results and may be helpful for interventions in difficult anatomical regions and for those requiring complex multi-angle trajectories.

Results

In total, all 560 punctures were performed successfully. Our results of a phantom puncture series show that the Maxio yields greater accuracy compared with the PCS and other image-guided intervention systems. Overall, the Maxio turned out to be the most accurate guidance system tested by our group.

Conclusion:

Although the robotic device provided more accurate results, both guidance systems showed acceptable results and may be helpful for interventions in difficult anatomical regions and for those requiring complex multi-angle trajectories.

In conclusion, the lower-cost system appears to achieve slightly (though statistically significant) lower accuracy than the higher-cost robotic system. Punctures with the Maxio are more accurate but more time consuming compared to the more affordable PCS. No significant loss in accuracy can be observed performing the planning scans in 1 to 5 mm slice thickness, reducing radiation exposure. Both navigation systems work reliably and may be easily included in the clinical routine. Nevertheless, both systems reach their limits for interventions needing multi-probe placements such as stereotactic radiofrequency ablation of multifocal liver tumors. Furthermore, the accuracy required depends on different clinical applications. The minimum required safety margin for certain tumors (i.e., HCC and colorectal liver metastasis) is >5 mm [18,19]. Therefore, using the Maxio robot the mismatch of 1 mm is negligible. However, mean deviations of 4 mm using the PCS may be insufficient for this purpose. Nonetheless, both guidance systems may play a promising role for interventions with difficult anatomical conditions and complex multi-angle trajectories.

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20) Starting CT-guided robotic interventional oncology at a UK centre

EDWARD W JOHNSTON, PhD, FRCR, EBIR, JODIE BASSO, BSc, JESSICA WINFIELD, PhD, JAMES MCCALL, MRCP, FRCR,NASIR KHAN, MRCP, FRCR, CHRISTINA MESSIOU, BMed Sci, BMBS, MD, MRCP, FRCR, DOW-MU KOH, MD, MRCP, FRCR and NICOS FOTIADIS, MD, PhD, FRCR, FCIRSE, EBIR

Royal Marsden Hospital, London, UK

Received: 22 February 2022 / Accepted: 07 March 2022 / Published: 18 March 2022

Objective

A commercially available CT-guided robot offers enhanced abilities in planning, targeting, and confirming accurate needle placement. In this short communication, we describe our first UK experience of robotic interventional oncology procedures. Methods We describe the device, discuss installation, operation, and report upon needle insertion success, accuracy (path deviation; PD and tip deviation; TD), number of adjustments, complications, and procedural success. Results Nine patients (seven males), median age 66 years (range 43–79) were consented for biopsy or abla-tion between March and April 2021. Needle placement in biopsy was more accurate than ablation (median 1 vs 11 mm PD and 1 vs 20 mm TD) and required fewer adjustments (median 0 vs 5). No complications arose, and all procedures were successful (diagnostic material obtained or complete ablation at follow-up).

Results

Nine patients (seven males), median age 66 years (range 43–79) were consented for biopsy or ablation between March and April 2021. Needle placement in biopsy was more accurate than ablation (median 1 vs 11 mm PD and 1 vs 20 mm TD) and required fewer adjustments (median 0 vs 5). No complications arose, and all procedures were successful (diagnostic material obtained or complete ablation at follow-up).

Conclusion

Short procedure times and very high levels of accuracy were readily achieved with biopsy proce-dures, although tumour ablation was less accurate which likely reflects higher procedural complexity.

We report our initial experience with CT guided robotic interventions at a UK centre. Whereas short procedures times and very high levels of accuracy were observed with biopsy procedures, antenna placement in tumour ablation was less accurate which likely reflects higher procedural complexity.

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21) Safety and Diagnostic Yield of 68Ga Prostate-specific Membrane Antigen PET/CT-guided Robotic-assisted Transgluteal Prostatic Biopsy

Rajender Kumar | Shrawan Kumar Singh | Bhagwant Rai Mittal | Shelvin Kumar Vadi | Nandita Kakkar | Harmandeep Singh | Venkata Subramanian Krishnaraju | Santosh Kumar Anish Bhattacharya

Departments of Nuclear Medicine (R.K., B.R.M., S.K.V., H.S., V.S.K., A.B.), Urology (S.K.S., S.K.), and Pathology (N.K.), PGIMER, Chandigarh, India

2022 Feb 22;204066. doi: 10.1148/radiol.204066.

Objective

To evaluate the safety and diagnostic yield of 68Ga PSMA PET/CT-guided, robotic-arm assisted transgluteal prostatic biopsy.

Results

Seventy-eight participants (mean age, 66 years ± 7 [standard deviation]; 36 participants [46%] with prior negative results at transrectal US-guided biopsy) were enrolled. Fifty-six (72%) participants had PSMA-avid lesions (prior negative results at transrectal US-guided biopsy in 22 of 56 [39%]) and underwent targeted biopsy. PCa was confirmed in 54 of 56 (96%) participants, and clinically significant PCa (Gleason score ≥ 7) was confirmed in 24 of 54 (44%). Two participants had nonrepresentative samples that required rebiopsy. All participants experienced pain during the procedure, mild (median visual analog scale score, 1; interquartile range, 1–2) in 36 of 56 (64%) and moderate (median visual analog scale score, 5; interquartile range, 5–6) in 20 of 56 (36%). Postprocedure complications were noted in five of 56 (9%) participants and were minor (hematuria, four participants; hematospermia, one participant; and gluteal pain, two participants). No participant developed a postprocedural infection.

Conclusion:

Transgluteal prostate-specific membrane antigen (PSMA) PET/CT-guided, robotic-targeted prostatic biopsy is safe with a high diagnostic yield of prostate cancer for PSMA-avid lesions. In conclusion, gallium 68 prostate-specific membrane antigen (PSMA) PET/CT-guided, robotic-assisted, transgluteal prostate biopsy is safe with a high diagnostic yield. This may be a useful approach in participants with negative results at prior transrectal US-guided biopsy and anteriorly placed PSMA-expressing lesions

https://doi.org/10.1148/radiol.204066

22) PET/CT-Guided Tissue Sampling in Patients With a Failed or Inconclusive CT-Guided Procedure Outcomes and Contributing Factors

Kumar, Rakesh MD, PhD*; Sharma, Anshul MD*; Thulkar, Sanjay MD†; Iyer, Venkateswaran K. MD‡; Sharma, Atul MD, DM§

Department of Nuclear Medicine, All India Institute of Medical Sciences

August 2020. | DOI: 10.1097/RLU.0000000000003128

Purpose:

The aim of this study was to analyze the effectiveness of PET/CT-guided sampling in patients with at least 1 instance of failed or inconclusive CT-guided procedure and factors determining the accurate sampling and complications.

Results:

Accurate lesion targeting was achieved in 81 cases (63 positive lesions, 12 confounding lesions, and 7 inadequate samples). Lesion was missed in 5 instances, and blood/necrotic tissue sampled in 19. Overall 18F-FDG–avid lesions were accurately targeted in 77.36% of patients (86.25% [biopsy] + 50% [FNAC]). Significant variables affecting targeting were needle gauge, deviation from intended entry point, procedure duration, procedure type, and patient movement. Using binomial regression, the significant parameters were procedure type (biopsy vs FNAC; odds ratio [OR], 5.916; $P = 0.002$), patient movement (OR, 0.275; $P = 0.023$), and procedure duration (OR, 1.195; $P = 0.011$). Overall complication rate was 21.70%, with 4.71% major complications. It was dependent on target depth (mean depth, 69.74 ± 20.29 mm [complications] vs 47.18 ± 22.60 mm; $P < 0.001$). Positive correlation was seen between the target depth and distance of needle from the intended target (Spearman ρ = 0.307; $P = 0.001$). In 28 procedures, the physician was asked to wear a pocket dosimeter, who received a mean dose of 2.52 (SD, 3.10) µSv.

Conclusions:

PET/CT-guided sampling should be considered where CT-guided biopsy has failed or is inconclusive. The outcome is impacted by needle gauge and patient movement, and complication rate is dependent on target depth.

https://doi.org/10.1097/rlu.0000000000003128

23) Robot-assisted navigation system for CT-guided intervention procedures for percutaneous lesions: Our experience at BIR, Chennai

Dr Iyengaran H, Assistant Professor, BIR, Chennai

Department of Radiology, Barnard Institute of Radiology, RGGGH, Chennai, Tamilnadu, India

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Objective

To evaluate the new Robot-assisted Navigation System for CT guided lung procedures with the assessment of the accuracy of needle placement, radiation dose and performance level.

Conclusion

Our experience demonstrated the effectiveness of the Robot-assisted Navigation system for CT-guided percutaneous interventions (including FNA, Biopsy, RFA, abscess drainage) with a lower radiation dose compared with conventionalCT-guidance procedures and similar radiation dose compared with CT fluoroscopy procedures. No radiation exposureto the interventional radiologists as compared with CT fluoroscopy procedures. The average Planning and Navigation time were 10 minutes and 8 minutes respectively, which was relatively not time-consuming. Performance level was excellent. The planning software was easy to learn and the robotic device was easy to handle. The targeting success ratefor a satisfactory intervention was 100%. Robot-assisted Navigation system is potentially valuable for more technically demanding procedures, like Irreversible Electroporation (IRE).

https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/recent_issues_pdf/2020/March/robot-assisted-navigation-system-for-ct-guided-intervention-procedures-for-percutaneous-lesions-our-experience-at-bir-chennai_March_2020_1582964261_8000503.pdf

24) Robot-assisted radio frequency ablation of primary and secondary liver tumours: early experience at BIR, Chennai

Dr Iyengaran H, Assistant Professor, BIR, Chennai

Department of Radiology, Barnard Institute of Radiology, RGGGH, Chennai, Tamilnadu, India

Volume-10 | Issue-2 | February - 2020 | PRINTISSN No. 2249 - 555X | DOI : 10.36106/ijar

Objective

To evaluate the technical success, radiation dose, safety and performance level of liver radiofrequency ablation using a computed tomography (CT)-guided robotic navigation system.

Conclusion

The system showed good accuracy for percutaneous needle placement for ablative therapy, with a radiation dosecomparable to the historical controls. Even though these preliminary data were promising, the study was not randomized. A randomized controlled study with a larger sample size comparing robotic and non-robotic assisted thermal ablation needs to be carried out to determine the outcomes. This clinical trial depicts that the robotic assisted planning and needle placement appears to be safe, with high accuracy and a comparable radiation dose to patients. Thus, making it acceptable for the routine clinical practice.

https://www.worldwidejournals.com/indian-journal-of-applied-research-(IJAR)/fileview/robotandndash-assisted-radio-frequency-ablation-of-primary-and-secondary-liver-tumours-early-experience-at-bir-chennai_February_2020_1580890401_7123567.pdf

25) Preliminary clinical application of the robot-assisted CT-guided irreversible electroporation ablation for the treatment of pancreatic head carcinoma

Xiao F. He | Yue Y. Xiao | Xiao Zhang Xiao B. Zhang | Xin Zhang | Ying T. Wei

Zhong L. Zhang | Phiipp Wiggermann

Department of Diagnostic Radiology, Medical School of Chinese PLA, Beijing, China

Received: 11 September 2019 | Revised: 8 January 2020 | Accepted: 23 February 2020

Objective

To evaluate the feasibility and safety of a robot-guided irreversible electroporation (IRE) ablation system for the treatment of pancreatic head carcinoma.

Results

Each probe was successfully punctured, and no complications were detected. *P*-values were calculated for all the parameters, using the SPSS 25.0 software and the *t* test.

Conclusion

The new robot can reduce the total operating time as compared to the manual probe placement with the same accuracyin the IRE of pancreatic head carcinoma.

https://doi.org/10.1002/rcs.2099

26) Robotic-assisted computed tomography-guided 18F-FDG PET/computed tomography-directed biopsy for diagnosis of intra thoracic lesions: An experience from a tertiary care centre in North India.

Alok Nath | Arun Prashanth | Hira Lal | Sheo Kumar| Sukanta Barai | Sanjay Gambhir

Nuclear Medicine Communications. 41(3):246-251, March 2020.

Objective

The aim of this study was to assess the diagnostic yield of robotic-assisted computed tomography (CT)-guided 18F- FDG PET/CT-directed biopsy for the evaluation of intrathoracic space occupying lesions.

Results

Tissue yield was 100% (*n* = 24) and histopathological diagnosis rate was 96% (*n* = 23). Out of the 24 lesions biopsied 30% (*n* = 8) were benign and 70% (*n* = 16) turned out to be malignant. The complication rates were pneumothorax 4% (*n* = 1) and haemothorax 4% (*n* = 1).

Conclusion

Robotic-assisted CT-guided 18F-FDG PET/ CT-directed biopsy is a useful and accurate technique for diagnostic evaluation of intrathoracic neoplasms with minimal complications rates as compared with conventional imaging techniques.

https://doi.org/10.1097/mnm.0000000000001148

27) Positron emission tomography/computed tomography guided percutaneous biopsies of Ga-68 avid lesions using an automated robotic arm

R. Kumar | B.R. Mittal | A. Bhattacharya | S.K. Vada | H. Singh | A. Bal, J. Shukla | H. Singh V. Sharma | A. Stood | S.K. Singh

Department of Nuclear Medicine and PET/CT, PGIMER, Chandigarh, India
Department of Pathology, PGIMER, Chandigarh, India
Department of Surgery, PGIMER,Chandigarh, India
Department of Gastroenterology, PGIMER, Chandigarh, India
Department of Urology, PGIMER, Chandigarh, India

2020 Mar;101(3):157-167. doi: 10.1016/j.diii.2019.10.006. Epub 2019 Nov 10.

Objective

The purpose of this prospective study was to evaluate the feasibility of positron emission tomography/computed tomography (PET/CT)-guided biopsy of Ga-68 avid lesions using an automated robotic arm and determine the diagnostic yield of this technique.

Results

The PET/CT-guided molecular sampling was technically successful in all the 25 (100.0%) patients without the need of repeat biopsies or further diagnostic evaluation with a diagnostic yield of 100%. The specimens were adequate for histopathological analysis, immunohistochemistry profiling and confirmed the final pathological diagnosis. Of the sixteen patients, who underwent Ga-68 DOTANOC PET/CT followed by guided molecular biopsy, histopathology revealed neuroendocrine tumors (*n* = 13), peripheral neuroectodermal tumor (*n* = 1), metastatic paraganglioma (*n* = 1), and high-grade B cell lymphoma (*n* = 1). In eight patients who underwent Ga-68 PSMA-PET/CT guided biopsy, pathology revealed metastatic prostate cancer in five, metastatic adenocarcinoma from the bladder, thymoma, and liposarcoma (one each). Chemokine analogue PET/CT guided biopsy revealed CXCR-4 receptor expression in a plasmacytoma.

Conclusion

A total of 25 patients (19 men, six women) with a mean age of 50.8 ± 17.3 (SD) years (range: 17-83 years) wereincluded. The biopsies were performed after PET/CT using Ga-68.

In conclusion, PET/CT-guided molecular biopsy using different Ga-68 labelled radiotracers is feasible and can be performed safely and accurately with a high diagnostic yield. These biopsies are helpful in accurately staging the disease when a tracer avid isolated distant lesion is evident on imaging and highly practical in patients with previous inconclusive biopsy sampling. The study also provides a justification for interventional PET imaging facilities in the near future.

https://doi.org/10.1016/j.diii.2019.10.006

28) CT-guided robotic-assisted percutaneous interventions: first experience

Burovik I.A.*, Prohorov G.G., Lushina P.A., Vasiliev A.V., Degtiareva E.A.

St. Petersburg State Medical University City Mariinsky Hospital, Saint-Petersburg, Russia

Published: 27-February-2019

Objective

Purpose: to demonstrate convenience, effectiveness and safety of robotic system for CT-guided interventions. Materials and methods. CT-guided percutaneous interventions were performed in FSBI "N.N. Petrov NMRC of Oncology" Ministry of Healthcare of The Russian Federation using the Philips Ingenuity CT scanner and Maxio Perfint robotic system. This article presents clinical observations of adrenal tumor biopsy and cryoablation of a renal cell carci-noma. For cryoablation the Medical Cryotherapeutic System was used. Results. The robotic system for CT-guided interven-tions allowed to perform corresponding surgical proce-dures.

Conclusion

The Maxio robotic console seems to be a promising technical solution for CT-guided interventions. Evaluation of the effectiveness of the robotic and traditional approaches of CT control in percutaneous procedures requires further investigations and analysis on larger data sample in longer periods of observation.

https://doi.org/10.24835/1607-0763-2019-2-27-35

29) [18]F-FDG PET/CT-Guided Real-Time Automated Robotic Arm–Assisted Needle Navigation for Percutaneous Biopsy of Hypermetabolic Bone Lesions: Diagnostic Performance and Clinical Impact

Rajender Kumar | Bhagwant Rai Mittal | Anish Bhattacharya |Harmandeep Singh | Amanjit Bal | Gaurav Prakash | Navneet Singh

Department of Nuclear Medicine and PET/CT, Nehru Hospital, PGIMER, Chandigarh, India
Department of Pathology, PGIMER, Chandigarh, India
Department of Hemato-Oncology, PGIMER, Chandigarh, India
Department of Pulmonary Medicine, PGIMER, Chandigarh, India

AJR 2019; 212:1–90361–803X/19/2121–1© American Roentgen Ray Society

Objective

The purpose of this study is to establish the feasibility, safety, diagnostic performance, and clinical impact of real- time intraprocedural 18F-FDG PET/CT-guided auto- mated robotic arm–assisted biopsy of hypermetabolic marrow or bone lesions.

Results

Of 73 patients evaluated, 34 (46.6%) were oncology patients with suspected metastasis or residual disease. Pathologic diagnosis was unknown for 38 patients (52.1%) with clinically suspected benign (n = 7) or malignant (n = 31) disease. The remaining patient was suspected of having skeletal sarcoidosis. Ten of the 34 oncology patients had minimal residual FDG uptake on the end-of-treatment PET/CT scan.

Conclusion

Real-time automated robotic arm–assisted PET/CT-guided hypermetabolic bone biopsy is technically feasible and can be performed safely with minimal complications. PET-guided biopsy has very high diagnostic performance and helps in precisely targeting the morphologically indeterminate bone or bone marrow lesions. The major clinical impact is noted for patients with minimal residual FDG uptake on the end-of-treatment PET/CT scan and patients with isolated distant suspected metastatic lesions. In addition to having all these benefits, real-time automated robotic arm–assisted PET/CT-guided bone biopsy was also helpful in individualized treatment planning.

https://doi.org/10.2214/AJR.18.19698

30) Image guided robotic interstitial brachytherapy, a new innovative treatment for malignancies

Bhaskar Vishwanathan | Sanjeet Kumar Mandal | Rishabh Kumar | HV Ramprakash

Department of Radiation Oncology, Vydehi Institue of Medical Sciences & Research Centre, Bengaluru, India

Department of Radiodiagnosis, Vydehi Institute of Medical Sciences & Research Center, Bengaluru, India

Hematol Med Oncol, 2018 doi: 10.15761/HMO.1000153 Volume 3(1): 2-4

Introduction

The evolution of brachytherapy has been refined over years, but many of the techniques remain unchanged. The limited utilisation of brachytherapy in comparison to conformal external radiotherapy may be due to its invasive approach, operative risk, technical challenge, time consuming, long learning curve and poor technological advancements. However, there is growing evidence for practicing hypo-fractionated regimes in many solid malignancies. The present article focus on the similar roles of image guided - robotic interstitial high dose rate brachytherapy with hepatocellular carcinoma (HCC) as prototype.

Conclusion

This is the first study in usage of image based robotic interstitial high dose rate brachytherapy for liver malignancies. The technique described is simple, safe, fast, precise and effective treatment modality for hepatocellular carcinoma. We also emphasis the image guided robotic interstitial brachytherapy as an exciting platform for its similar role to ablate liver metastases or other site malignancies.

To the best of our knowledge and literature review, this is the first study in usage of image based robotic interstitial high dose rate brachytherapy for liver malignancies. The technique described is simple, safe, fast, precise and effective treatment modality for hepatocellular carcinoma. We also emphasis the image guided robotic interstitial brachytherapy as an exciting platform for its similar role to ablate liver metastases or other site malignancies.

https://www.oatext.com/image-guided-robotic-interstitial-brachytherapy-a-new-innovative-treatment-for-malignancies.php#:~:text=Image%20Guided%20%2D%20Robotic%20Interstitial%20Brachytherapy%2C%20a%20new%20innovative%20interstitial%20brachytherapy,thereby%20delivering%20high%20dose%20to

31) Diagnostic performance of real-time robotic arm assisted ^{18}F- FDG PET/CT-guided percutaneous biopsy in metabolically active abdominal and pelvic lesions

Rajender Kumar | Bhagwant Rai Mittal | Anish Bhattacharya | Harmandeep Singh | Amanjit Bal | Shelvin Kumar Vadi | Ashwani Sood | Gaurav Prakash | Harjeet Singh | Aman Sharma

PMID: 30167803 DOI: 10.1007/s00259-018-4133-x

Objective

To evaluate the feasibility and diagnostic performance of 18F-FDG PET/CT-guided biopsy of abdominal andpelvic lesions with automated robotic arm (ARA) assistance.

Results

The lesions were successfully targeted in 110 of the 114 patients (96.5%) and yielded a pathological diagnosis. Pathological diagnoses were confirmed in 50 of the 54 patients with a prior inconclusive biopsy. Of the 110 lesions, 82 were malignant, 20 were benign, and 8 showed minimal residual FDG uptake at the end of treatment and had no active disease even on clinical and imaging follow-up of at least 3 months. Findings were true-positive in 102 lesions, false-positive in none, true-negative in eight and false-negative in four. The procedure showed sensitivity, specificity, positive predictive value, negative predictive value and accuracy of 96.2%, 100%, 100%, 66.7 and 96.5%, respectively. No immediate complications or delayed life-threatening events were observed.

Conclusion

Percutaneous biopsy of metabolically active abdominal and pelvic lesions with ARA assistance is a technically feasible, safe and accurate method for pathological diagnosis with high diagnostic performance. PET-guided biopsy is highly practical and useful in patients, especially in those with a previous inconclusive biopsy.

https://doi.org/10.1007/s00259-018-4133-x

32) Surgeons can quickly and accurately perform image guided needle placement using robotic assistance

Abigail J Fong, MD, Camille L Stewart, MD, Kelly Lafaro, MD, Christopher J LaRocca, MD, Dominic Femino, MD, BrookeCrawford, MD City of Hope, Duarte, CA

Journal of the American College of Surgeons · October 2019

DOI: 10.1016/j.jamcollsurg.2019.08.1073

Objective

MAXIO is a FDA-approved image-guidance robot that performs physician controlled, CT guided needle placement (Perfint Healthcare, Redmond, WA). This technology can be used for surgical planning, biopsy, drug delivery or ablation. Potential benefits include improved accuracy, fewer needle passes, and reduced patient radiation. We sought to determine what surgeon learning and proficiency is using the robotic arm.

Results

All participants successfully placed needles into pre-specified targets using the robotic arm. The average needle vector distance from the target was 2.3±1.2 mm. Average time for needle placement was 3:44±1:43 minutes. Time for needle placement decreased for all participants with subsequent attempts, with average third placement taking 2:29±1:51 minutes. Only one error in these attempts resulted in need for additional CT scan. No errant needle placement occurred.

Conclusion

Surgeons with minimal training are able to place percutaneous needles under CT guidance quickly, accurately, and reproducibly using a robotic arm. This suggests that robotic technology can enhance adoption of CT-image guidance in surgery, and enable surgeons to perform percutaneous needle-based procedures safely and efficiently.

https://doi.org/10.1016/j.jamcollsurg.2019.08.1071

33) Planning and guidance: New tools to enhance the human skills in interventional oncology

L.P. Beyer, P. Wiggermann

Department of Radiology, University Medical Center Regensburg, Franz-Josef-Strauß-Allee 11, 93053 Regensburg, Germany

2017 Sep;98(9):583-588. doi: 10.1016/j.diii.2017.07.004. Epub 2017 Aug 14.

Abstract

Navigation systems have the potential to achieve a high accuracy for percutaneous ablation of tumors even for those in difficult locations. In the last years, successful research has been conducted to make navigation devices applicable to percutaneous tumor ablation with special planning software that now allows high accuracy even for deep-located small lesions close to critical structures. Because of the high number of available navigation systems, this review focuses on those with preexisting clinical studies.

Conclusion

In comparison to optical or electromagnetic tracking systems, where the ablation probe is placed manually guided through continuous tracking of the instrument, guidance of the ablation probe can be conducted actively by the navigation system in robot-assisted navigation. Therefore, insertion direction of the ablation probe is predetermined by the navigation device (Fig. 2). A number of meanwhile commercially available robotic systems have been developed in the context of research projects. These robotic systems differ in regard to registration, MRI-compatibility, range of movement (DOF — degrees of freedom) and specific planning possibilities for percutaneous ablations. A review about the available robotic systems has been published by Cleary et al. [2] und Kettenbach and Kronreif [3]. Registration of the robotic coordinate system and the image coordinate system has to be performed analogous to the tracking systems. If the robot system is placed in a fixed position in relation to the CT table, registration might be replaced by calibration. In all other cases, electromagnetic/optical tracking, radiopaque markers attached to the robotic arm (e.g. iSYS®, iSYS Medizintechnik GmbH, Kitzbuehel, Austria) or laser alignment processes (e.g. AcuBot®, Johns Hopkins Medical Institutions, Baltimore, MD, USA) are used for registration. To prove the superiority of robot assistance for percutaneous tumor ablation, procedure outcome variables for the robot-assisted and manual approach should ideally be compared in randomized patient studies.

https://doi.org/10.1016/j.diii.2017.07.004

Navigation device	Tracking and registration method	Respiratory gating	Ablation technique/ Organ	No. of patients/ ablated tumous	Effectiveness and recurrence rates	Technical accuracy
Own development	Optical (skin fiducials)	Tube disconnection	RFA/liver	90/177 (72 HCC, 105 metastases)	Technical effectiveness: < 3 cm: 95.9%; 3—5 cm; 100%; > 5 cm: 87.5% 1-year local recurrence: 2.0%	N/A
Own development	Optical (skin fiducials)	Tube disconnection	RFA/liver	63/189 (CRC metastases)	Local recurrence: < 3 cm: 17.7%; 3—5 cm; 11.1%; > 5 cm: 17.4%	N/A
Own development	Optical (skin fiducials)	Tube disconnection	RFA/liver	11/36 (cholangiocarcinoma)	Technical effectiveness: 92% Local recurrence: 8%	N/A

Own development	Optical (skin fiducials)	Tube disconnection	RFA/liver	20/75 (melanoma metastases)	Technical effectiveness: 89.3% Local recurrence: 13.3%	N/A
CAS-One I	Optical (skin fiducials)	HFJV	MWA/liver	17/25 (17 HCC, 8 metastases)	N/A	Lateral error: 5.8 ± 3.2 mm Depth error: 3.4 ± 3.2 mm Total error: 5.8 ± 3.2 mm
CAS-One I	Optical (skin fiducials)	Tube disconnection	MWA/liver	7/14 (8 HCC, 6 metastases)	N/A	Lateral error: 5.8 ± 3.2 mm Depth error: 3.4 ± 3.2 mm Total error: 5.8 ± 3.2 mm
CAS-One I	Optical (skin fiducials)	Tube disconnection	IRE/liver	7/14 (8 HCC, 6 metastases)	Technical effectiveness: 100%	Lateral deviation b: 6.4 ± 2.6 degrees of arc

AcuBot	Laser alignment	NA	RFA/liver	14/NA	Technical effectiveness: > 90% 6-month local recurrence: 0%	N/A
ROBIO^{TM} EX	Docking	Tube disconnection	RFA/liver	11/17 (10 HCC, 7 metastases)	Technical effectiveness: 100%	Readjustments: 0.4
MAXIO^{TM}	Docking	Breath Hold	MWA/liver	30/85 (33 HCC, 29 CCC, 23 metastases)	N/A	Readjustments: 1.1. AAD: 5.3 ± 1.8 mm
MAXIO^{TM}	Docking	Tube disconnection	RFA and MWA/liver	30/85 (33 HCC, 29 CCC, 23 metastases)	Technical effectiveness: 100%	Readjustments: 0.8
MAXIO^{TM}	Docking	Tube disconnection	MWA/liver	22/34 (24 HCC, 10 metastases)	Technical effectiveness: 94% (32 of 34)	Readjustments: 0.4 (14 of 34). AAD: 3.1 ± 2.5 mm
MAXIO^{TM}	Docking	Tube disconnection	IRE/liver	17/21 (7 HCC, 14 metastases)	Technical effectiveness: 100% (21 of 21)	Lateral deviation: 4.2 ± 1.9 degrees of arc

34) PET/CT-guided biopsy using automated robotic biopsy arm Post- therapy lesions in patients with non-Hodgkin’s lymphoma characterized by ^{18}F-FDG

Renjith K. Radhakrishnan | Bhagwant R. Mittal | Rajender K. Basher Gaurav Prakash | Pankaj Malhotra | Naveen Kalra | Ashim Das

2018 Jan; 39(1):74-82. doi: 10.1097/MNM.0000000000000780

Objective

The aim of this study was to analyse the positive predictive value (PPV) of post-therapy fluorine- 18-fluorodeoxyglucose (18F-FDG) PET/CT performed for response or recurrence evaluation in patients with non- Hodgkin‘s lymphoma (NHL) and to appraise the diagnostic utility of 18F-FDG PET/CT-guided biopsyin this setting.

Results

In all, 15 of the 17 (88.5%) procedures yielded adequate representative tissue samples. Nine out of 15 lesions were positive for residual disease and the remaining revealed benign findings on histopathology. One patient with inconclusive biopsy underwent surgical resection and histopathology confirmed the presence of residual disease. PPV of the^{18}F-FDG PET/CT was observed to be 62.5% (10/16).

Conclusion

^{18}F-FDG PET/CT for response evaluation in NHL possesses a low PPV and hence warrants histopathological correlation when 18F-FDG PET/CT findings influence management decision. Diagnostic yield of 18F-FDG PET/CT-guided biopsy is high and has the potential to reduce sampling errors.

https://doi.org/10.1097/mnm.0000000000000780

35) Real-time intraprocedural ^{18}F-FDG PET/CT-guided biopsy using automated robopsy arm (ARA) in the diagnostic evaluation of thoracic lesions with priorinconclusive biopsy results: initial experience from a tertiary health care centre

Renjith Kalathoorakathu Radhakrishnan | Bhagwant Rai Mittal | Arun Kumar Reddy Gorla
Rajender Kumar Basher | Ashwani Sood | Amanjit Bal | Naveen Kalra | Niranjan Khandelwal
Navneet Singh | Digambar Behera

Department of Nuclear Medicine and PET, PGIMER,Chandigarh, India
Department of Radiodiagnosis, PGIMER, Chandigarh,India
Department of Pulmonary Medicine, PGIMER, Chandigarh, India

2017 Dec;90(1080):20170258. doi: 10.1259/bjr.20170258. Epub 2017 Oct 27.

Objective

The aim of this study was to assess the feasibility and appraise the diagnostic utility of real time 18F-FDGPET/CT-guided biopsy under auto-mated robopsy arm (ARA) guidance for the evaluation of thoracic lesions with prior inconclusive biopsy results.

Results:

Adequate representative tissue sample could be retrieved in all the patients. No major procedure-related complications were encountered in any patient. Of the 25 procedures, 21 lesions were positive for malignancy and benign findings were observed in the other 4 lesions on histopathology. None of the patients required further biopsy in arriving at a final diagnosis. Overall diagnostic yield of the procedure was 100%.

Conclusion

Real time 18F-FDG PET/CT guidance for percutaneous biopsies of lung and mediastinal lesions is a feasible technique with potential utility in patients with previous inconclusive biopsy results.

https://doi.org/10.1259/bjr.20170258

36) Evaluation of a robotic system for irreversible electroporation (IRE) of malignant liver tumors: initial results

L.P Beyer | B. Pregler | K. Michalik | C.Niessen | M. Dolliger | M. Muller | H.J. Schlitt
C. Stroszcynski | P. Wiggermann

2017 May;12(5):803-809. doi: 10.1007/s11548-016-1485-1. Epub 2016 Sep 21.

Objective

Comparison of conventional CT-guided manual irreversible electroporation (IRE) of malignant liver tumors and a robot-assisted approach regarding procedural accuracy, intervention time, dose, complications, and treatment success.

Results

The time from the planning CT scan to the start of the ablation as well as the dose-length product were significantly lower under robotic assistance (63.5 vs. 87.4 min, ; 2132 vs. 4714 mGy cm,). The procedural accuracy, measured as the deviation of the IRE probes with respect to a defined reference probe, was significantly higher using robotic guidance (2.2 vs. 3.1 mm,). There were no complications. There was one incomplete ablation in the manual group.

Conclusion

Robotic assistance for IRE of liver tumors allows for faster procedure times with higher accuracy while reducingradiation dose as compared to the manual placement of IRE probes.

https://doi.org/10.1007/s11548-016-1485-1

37) Robot-assisted microwave thermo ablation of liver tumors: a single-center experience

L.P Beyer | B. Pregler | C.Niessen | M. Dolliger | B.M Graf | M. Muller | H.J. Schlitt | C. Stroszcynski | P. Wiggermann

2016 Feb;11(2):253-9. doi: 10.1007/s11548-015-1286-y. Epub 2015 Aug 26.

Objective

To evaluate and compare the needle placement accuracy, patient dose, procedural time, complication rate and ablation success of microwave thermo ablation using a novel robotic guidance approach and a manual approach.

Results

The total procedure time and dose-length product were significantly reduced under robotic guidance (18.3 vs. 21.7 min, ; 2216 vs. 2881 mGycm,). The position of the percutaneous needle was more accurate using robotic guidance (needle deviation 1.6 vs. 3.3 mm,). There was no significant difference between both groups regarding the complication rate and the ablation success.

Conclusion

Robotic assistance for liver tumor ablation reduces patient dose and allows for fast positioning of the microwave applicator with high accuracy. The complication rate and ablation success of percutaneous microwave thermo ablation of malignant liver tumors using either CT fluoroscopy or robotic guidance for needle positioning showedno significant differences in the 6-week follow-up.

https://doi.org/10.1007/s11548-015-1286-y

38) Image-guided microwave thermo ablation of hepatic tumours using novel robotic guidance: an early experience

Emmanuel C. Mbalisike | Thomas J. Vogl | Stefan Zangos | Katrin Eichler | Prakash Balakrishnan
Jijo Paul

2015 Feb;25(2):454-62. doi: 10.1007/s00330-014-3398-0. Epub 2014 Aug 23.

Objective

To evaluate and compare novel robotic guidance and manual approaches based on procedural accuracy, procedural time, procedural performance, image quality as well as patient dose during image-guided microwave thermo ablation.

Result

Accuracy parameters were significantly higher in group 2 (all $p < 0.05$). Total procedural time showed a mean time difference of 3 min (group 2 > group 1; $p = 0.0008$). Volume CT dose index and dose–length product were significantly lower for group 2 compared to group 1 (all $p < 0.05$) for CT fluoroscopy imaging. Total procedural performance score was higher for group 2 compared to group 1 ($p = 0.0001$). Image quality parameters were insignificant between examined groups.

Conclusion

The novel robotic guided approach improved the accuracy of targeting the target tumour, reduced patient doseand increased procedural performance (which influences the procedural safety) during ablation.

https://doi.org/10.1007/s00330-014-3398-0

39) Robot-assisted microwave thermo ablation of liver tumors: a single-center experience

Basri Johan Jeet Abdullah | Chai Hong Yeong | Khean Lee Goh | Boon Koon Yoong

Gwo Fuang Ho | Carolyn ChueWai Yim | Anjali Kulkarni

2015 Feb;25(2):454-62. doi: 10.1007/s00330-014-3398-0. Epub 2014 Aug 23.

Objective

This study aimed to assess the technical success, radiation dose, safety and performance level of liver thermalablation using a computed tomography (CT)- guided robotic positioning system.

Results

Thermal ablation was successfully completed in 20 patients with 40 lesions and confirmed on multiphasic contrast-enhanced CT. No procedure related complications were noted in this study. The average number of needle readjustment was 0.8 ± 0.8. The total CT dose (DLP) for the entire robotic assisted thermal ablation was 1382 ± 536 mGy.cm, while the CT fluoroscopic dose (DLP) per lesion was 352 ± 228 mGy.cm. There was no statistically significant ($p > 0.05$) dose reduction found between the robotic-assisted versus the conventional method.

Conclusion

This study revealed that robotic-assisted planning and needle placement appears to be safe, with high accuracy and a comparable radiation dose to patients.

https://doi.org/10.1007/s00330-014-3391-7

40) Robot-assisted radiofrequency ablation of primary and secondary liver tumours: early experience

Basri Johan Jeet Abdullah | Chai Hong Yeong | Khean Lee Goh | Boon Koon Yoong
Gwo Fuang Ho | Carolyn Chue Wai Yim | Anjali Kulkarni

2014 Jan;24(1):79-85.doi: 10.1007/s00330-013-2979-7. Epub 2013 Aug 9.

Objective

Computed tomography (CT)-compatible robots, both commercial and research-based, have been developed with the intention of increasing the accuracy of needle placement and potentially improving the outcomes of therapies in addition to reducing clinical staff and patient exposure to radiation during CT fluoroscopy. In the case of highly inaccessible lesions that require multiple plane angulations, robotically assisted needles may improve biopsy access and targeted drug delivery therapy by avoidance of the straight-line path of normal linear needles.

Conclusion

Robotic-assisted planning and needle placement appears to have high accuracy, is technically easier than the non-robotic-assisted procedure, and involves a significantly lower radiation dose to both patient and support staff.

In conclusion, we present our early experience of robotic-assisted CT-guided RFA for both primary and secondary liver tumours. We have been able to show that the automated system works well and could provide technical and diagnostic success rates similar to those obtained with the manual method. Also, we found that the automated device decreased the number of needle position adjustments and thereby minimised the procedure time. The robotic device showed good accuracy for percutaneous needle placement for RFA therapy with a lower radiation dose compared with historical controls. From our preliminary study we found that the robot provides high accuracy with only a few readjustments required. Even though these preliminary data were promising, the study was not randomised. In future a randomised study comparing the robotic and non-robotic-assisted RFA needs to be carried out with a larger sample size to determine the cost-effectiveness in terms of time, cost and radiation dose to both patients and operators. There is also a need for larger multi-centre studies for cross-centre comparison.

https://doi.org/10.1007/s00330-013-2979-7

41) Robot-Assisted Navigation System for Percutaneous CT Guided Biopsies with a Comparison of Conventional Manual Technique

Dr.Anandakumar, Head of the Department - Radiology, Nodal officer

Tamil Nadu Government Multi Super Specialty Hospital

(IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 12 Ver. XI (Dec. 2017), PP 01-06 www.iosrjournals.org

Objective

To evaluate the performance of a robotic system for CT-guided biopsy in comparison to the conventional manual technique.

Results

All biopsies were successfully performed under CT guidance in both groups. In group A procedure

duration was significantly shorter(p=0.001) when compared to group A. DLP was lower-both the total DLP and DLP of check scan verification, and just occasional needle adjustments were required as compared to group B. The RMS (i,e) orbital(transversal on the x-axis) and craniocaudal (longitudinal on the z-axis) angular deviations from the projected needle path in robot-assisted biopsies were 1.2±1.01°. The diagnostic performance of CT-guided biopsies was similar in the two groups. The rate of complications was significantly lesser in group A when compared to group B, with just 2% of complication in robot assisted procedure and 11% in conventional procedure.

Conclusion

Results of our study demonstrate that robot-assisted CT-guided biopsy is a safe and accurate interventional technique that can reduce procedure duration and radiation dose in comparison to the conventional manual approach even in expert hands. Further studies are needed to confirm these data and to evaluate the performance of robot-assisted interventional procedures in other clinical scenarios.

https://www.iosrjournals.org/iosr-jdms/papers/Vol16-issue12/Version-11/A1612110106.pdf

42) Preliminary clinical experience with a dedicated interventional robotic system for CT-guided biopsies of lung lesions: a comparison with the conventional manual technique

Michele Anzidei |Renato Argirò | Andrea Porfiri | Fabrizio Boni | Marco Anile | Fulvio Zaccagna | Domenico Vitolo | LucaSaba | Alessandro Napoli | Andrea Leonardi | Flavia Longo | Federico Venuta | Mario Bezzi | Carlo Catalano

2015 May;25(5):1310-6. doi: 10.1007/s00330-014-3508-z. Epub 2014 Nov 23.

Objective

Evaluate the performance of a robotic system for CT-guided lung biopsy in comparison to the conventionalmanual technique.

Results

All biopsies were successfully performed. The size ($p = 0.41$), distance from entry point ($p = 0.86$) and position in lung ($p = 0.32$) of target lesions were similar in both groups ($p = 0.05$). Procedure duration and radiation dose were significantly reduced in group A as compared to group B ($p = 0.001$). Precision of needle positioning, diagnostic performance of the biopsy and rate of complications were similar in both groups ($p = 0.05$).

Conclusion

Robot-assisted CT-guided lung biopsy can be performed safely and with high diagnostic accuracy, reducing procedure duration and radiation dose in comparison to the conventional manual technique.

https://link.springer.com/article/10.1007/s00330-014-3508-z

43) Robot-assisted navigation system for CT- guided percutaneous lung tumour procedures: our initial experience in Hong Kong

CM Chu , SCH Yu From International Cancer Imaging Society (ICIS) 14th Annual Teaching Course, Heidelberg, Germany. 9-11 October 2014

Department of Imaging and Interventional Radiology The Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, N.T., HongKong

Scientific session presentation, doi:10.1186/1470-7330-14-S1-S5, Published: 09 October 2014

Objective

To evaluate the new robot-assisted navigation system for CT-guided lung tumour procedures.

Results

There were 7 male and 3 female patients in the robotic group. Average age was 72.1 years (range 67-78). 8 patients underwent lung biopsy while the rest had thermal ablation or fiducial marker insertion. Average lesion size was 2.8cm (range 1.9-4.1cm). Average lesion depth was 6.2cm (range 3.7-8.6cm). All interventions met the primary endpoint of satisfactory instrument positioning. Average performance levels were 4.5. Average radiation dose (Dose Linear Product) was 480.4 (range 196.5-959.8) whereas conventional CT-guidance was 645.4 (range 285.1-1043.5) and CT-fluoroscopy was 460.1 (range 214.2-1157.0).

Conclusion

Our initial experience demonstrated effectiveness of the robot-assisted navigation system for CT-guided lung tumour interventions with lower radiation dose compared with conventional CT-guided procedures. Radiation doses were similar to CT-fluoroscopy without radiation exposure to interventional radiologists. Targeting success rate for satisfactory intervention was 100%.

https://cancerimagingjournal.biomedcentral.com/articles/10.1186/1470-7330-14-S1-S5

44) Comparison of CT Fluoroscopy-Guided Manual and CT-Guided Robotic Positioning System for In Vivo Needle Placements in Swine Liver

F. Cornelis | H. Takaki | M. Laskhmanan | J. C. Durack | J. P. Erinjeri | G. I. Getrajdman | M. Maybody |C. T. Sofocleous | S. B. Solomon | G. Srimathveeravalli

Interventional Radiology Service, Memorial Sloan-Kettering Cancer Center, New York, USA

Department of Radiology, Pellegrin Hospital, Place Amélie Raba Léon, Bordeaux, France Perfint Healthcare Inc, Chennai, Tamil Nadu, India

2015 Oct;38(5):1252-60. doi: 10.1007/s00270-014-1016-9. Epub 2014 Nov 7.

Objective

To compare CT fluoroscopy-guided manual and guided robotic positioning system (RPS)-assisted needleplacement by experienced IR physicians to targets in swine liver.

Results

Paired comparison of manual and RPS-assisted placements to a target by the same physician indicated accuracy outcomes was not statistically different (manual: 4.53 mm; RPS: 4.66 mm; $p = 0.41$), but manual placement resulted in higher total radiation dose (manual: 1075.77 mGy/cm; RPS: 636.4 mGy/cm; $p = 0.03$), required more confirmation scans (manual: 6.6; RPS: 1.6; $p < 0.0001$) and needle manipulations (manual: 4.6; RPS: 0.4; $p < 0.0001$). Procedure time for RPS was longer than manual placement (manual: 6.12 min; RPS: 9.7 min; $p = 0.0003$). Comparison of inter-physician performance during manual placement indicated significant differences in the time taken to complete placements ($p = 0.008$) and number of repositions ($p = 0.04$) but not in other study measures ($p > 0.05$). Comparison of inter-physician performance during RPS-assisted placement suggested statistically significant differences in procedure time ($p = 0.02$) and not in other study measures ($p > 0.05$)

Conclusion

CT-guided RPS-assisted needle placement reduced radiation dose, number of confirmatory scans, and needle manipulations when compared to manual needle placement by experienced IR physicians, with equivalent accuracy.

https://doi.org/10.1007/s00270-014-1016-9

45) Technical note: CT-guided biopsy of lung masses using an automated guiding apparatus

Amarnath Chellathurai | Saneej Kanhirat | Kabilan Chokkappan| Thiruchendur S Swaminathan Nadhamuni Kulasekaran

BIR, Madras Medical College, Government General Hospital, Chennai, India

Jul-Sep 2009;19(3):206-7. doi: 10.4103/0971-3026.54883.

Objective

Automated guiding apparatuses for CT-guided biopsies are now available. We report our experience with an indigenous system to guide lung biopsies. This system gave results similar to those with the manual technique. Automated planning also appears to be technically easier, it requires fewer number of needle passes, consumes less time, and requires fewer number of check scans.

Conclusion

In our opinion, such automated systems can be extremely useful when the radiologist doing the biopsy has limited experience or when the lesion is situated in difficult locations. Larger trials are required to assess the usefulness and cost-effectiveness of such automated systems in different clinical environments.

[Perfint_PIGA.pdf (perfinthealthcare.com)](Perfint_PIGA.pdf)

46) Computed Tomography Guided Percutaneous Liver Biopsy Using a Robotic Assistance Device—A Corpse Study

Boris Schulz | Katrin Eichler | Firas Al-Butmeh |Claudia Frellesen | Christoph Czerny Thomas Vogl | Stephan Zangos

Clinic of the Goethe University, Department of Diagnostic and Interventional Radiology, Theodor -Stern-Kai Clinic of the Goethe University, Department of Trauma Surgery, Theodor-Stern-Kai 7, Frankfurt, Germany

DOI:10.4236/OJRAD.2015.52014 Corpus ID: 6361769

Objective

To investigate a robot assistance device for CT-guided percutan liver biopsy.

Conclusion

The proposed robotic assistance device may be superior for angulated interventions regarding accuracy and timely effort. Furthermore, the zero-radiation exposure is a significant benefit for the interventional radiologist.

https://www.researchgate.net/publication/279244114_Computed_Tomography_Guided_Percutaneous_Liver_Biopsy_Using_a_Robotic_Assistance_Device-A_Corpse_Study

47) Robot assisted percutaneous placement of K-wires during minimal invasive spinal interventions

Christoph Czerny | Katrin Eichler | Boris Schulz | Christof Schomerus | Thomas J. Vogl
Ingo Marzi | Stephan Zangos

Department of Trauma Surgery, University Hospital Frankfurt, Goethe-University Frankfurt,

Frankfurt am Main, Germany, Department of Diagnostic and Interventional Radiology

2019 Dec;28(6):373-380.doi: 10.1080/13645706.2018.1544567. Epub 2018 Nov 15.

Objective

To assess the accuracy and time requirements of image-guided percutaneous K-wire insertion in the spine using an advanced robot assistance device for needle guidance and to demonstrate a radiation-free workflow for the physician..

Results:

All procedures were carried out without any perforation of the pedicle wall. The mean duration of planning the intervention path was 2:54 ± 2:22 min, mean positioning time was 2:04 ± 0:42 min and the mean time for K-wire insertion was 2:13 ± 0:54 min. In total, the average intervention time was 7:10 ± 3:06 min per pedicle. Compared to the planning, the K-wire position showed a mean deviation of 0.5 mm in the vertical-axis and 1.2 mm in the horizontal-axis. The average intervention path length was 8.1 cm.

Conclusion:

Our findings show a high accuracy in robot-assisted K-wire insertion during spinal interventions without any exposure of the operator to radiation.

https://doi.org/10.1080/13645706.2018.1544567

48) Accuracy of Tumour Targeting Using A CT-Compatible Robotic System - A Phantom Study

B. J. J. Abdullah, C. H. Yeong, K. H. Ng; Kuala Lumpur/M Y

University of Malaya Research Imaging Centre and Department of Biomedical Imaging, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia

C-1942 ECR 2014 Scientific Exhibit

Objective

A new CT-compatible robotic system, MAXIO was developed by Perfint Healthcare, USA to assist tumour targeting in biopsy and interventional procedures. This study aimed to evaluate the accuracy of the robotic system in tumour targeting.

Conclusion

The MAXIO robotic system achieved high accuracy of ±2 mm in tumour targeting. It showed great potential to improve accuracy and minimize radiation exposure during CT-guided biopsy or interventional procedures.

https://dx.doi.org/10.1594/ecr2014/C-1942

49) Accuracy and efficacy of percutaneous biopsy and ablation using robotic assistance under computed tomography guidance: a phantom study

Yilun Koethe | Sheng Xu | Gnanasekar Velusamy | Bradford J. Wood | Aradhana M. Venkatesan

Eur Radiol. 2014 Mar; 24(3): 723–730.

Published online 2013 Nov 13. doi: 10.1007/s00330-013-3056-y

Objective

To compare the accuracy of a robotic interventional radiologist (IR) assistance platform with a standard freehand technique for computed-tomography (CT)-guided biopsy and simulated radiofrequency ablation (RFA).

Conclusion

In conclusion, results from the use of this novel IR assistance platform suggest that it might play a promising role for percutaneous CT-guided biopsies and ablations. Its use was associated with improved needle placement accuracy for complex, multi-angle trajectories and greater ablation coverage for large targets compared with the freehand technique. .

MAXIO_NIH paper.pdf (perfinthealthcare.com)

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