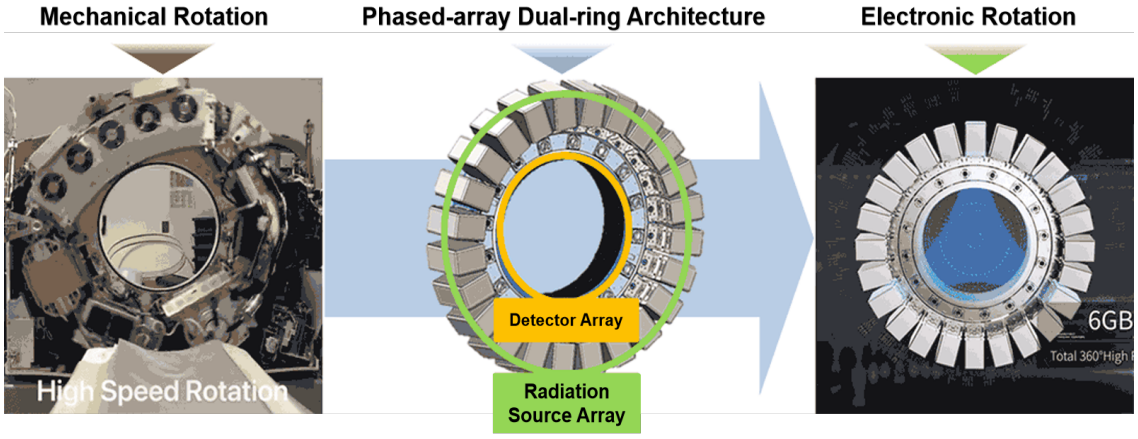
Prospects for the Application of Phased-Array CT in the Diagnosis and Treatment of Digestive System Diseases: A Survey

Phased-array computed tomography (PACT) is an electronically controlled imaging system based on a full-circle detector array and a distributed X-ray source array. Its core concept draws on the principles of phased-array technology, replacing the mechanical rotation of the X-ray tube and detector in conventional spiral CT with X-ray electron steering based on the coordination of multiple X-ray sources, thereby completely revolutionizing the imaging mechanism of traditional spiral CT.



According to reports, the core clinical value of phased-array CT lies in the following:

I. Ultra-early diagnosis of tumors: A qualitative leap from “centimeters” to “micrometers.”

1. Visualization of smaller functional units within the human body, capable of identifying early signs of cancer at the 100-micrometer level;

2. Benign vs. malignant differentiation: Ultra-high-definition imaging at 3072×3072 pixels (compared to only 512×512 in traditional CT) reveals subtle structural details of lesions, thereby avoiding unnecessary surgical interventions.

3. Precision tumor management: Micrometer-level resolution combined with a 144-fold increase in information per scan allows for tracking dynamic changes in millimeter-sized metastatic lesions, enabling comprehensive monitoring throughout the entire disease course—from screening and staging to treatment efficacy assessment.

II. Low-Dose Safety and Applications for Special Populations

1. Radiation dose is reduced by more than 50%. Through adaptive dose control algorithms, radiation exposure is minimized while resolution is enhanced, benefiting children, pregnant women, and patients requiring long-term follow-up (such as those with lymphoma or inflammatory bowel disease).

2. Dynamic organ imaging: Millisecond-level temporal resolution captures physiological processes such as swallowing and breathing, enabling applications in

emerging fields such as the assessment of swallowing dysfunction and airway dynamics research.

Prospects for the Application of Phased Array CT in the Diagnosis and Treatment of Digestive Diseases: Survey Questionnaire

Informed Consent and Explanation. Dear Experts and Colleagues: Greetings! We sincerely invite you to participate in this academic survey. This study aims to explore the application potential and clinical needs of the next-generation “phased-array CT” (a revolutionary CT technology that replaces mechanical rotation with electronic scanning, enabling micron-level resolution and millisecond-level dynamic imaging) in the field of digestive system diseases (including the liver, gallbladder, pancreas, spleen, and gastrointestinal tract).Your professional insights will significantly influence future technological development and clinical research directions. This study is an anonymous survey; all data will be used solely for aggregate statistical analysis, and your personal privacy will never be disclosed. Completing the questionnaire takes approximately 5 minutes. By participating, you consent to the use of your data for this scientific research. Thank you for your valuable time and contribution! [Single-choice question]

Options	Subtotal	Percentage
Agree	112	100%
Disagree	0	0%
Number of valid responses	112	

Part 1: Basic Information

1. Your professional title: [Single-choice question]

Options	Subtotal	Percentage
Resident	27	24.11%
Attending Physician	47	41.96%
Associate Chief Physician	26	23.21%
Chief Physician	12	10.71%
Number of valid responses to this question	112	

2. The grade of your medical institution: [Single-choice question]

Options	Subtotal	Percentage
Grade A, Level 3 Hospital	64	57.14%
Grade 3B Hospitals	33	29.46%
Class II, Grade A Hospital	8	7.14%
Other	7	6.25%
Number of valid responses for this question	112	

3. Which department do you work in? [Single-choice question]

Options	Subtotal	Percentage
Gastroenterology	74	66.07%
Gastroenterology Surgery	38	33.93%
Number of valid responses for this question	112	

4. Your primary subspecialty areas of practice (multiple selections allowed): [Multiple-choice question]

Options	Subtotal	Percentage
Liver diseases (liver tumors, cirrhosis, portal hypertension, etc.)	41	36.61%

Biliary tract diseases	29	25.89%
Pancreatic diseases (pancreatitis, pancreatic tumors, etc.)	31	27.68%
Gastrointestinal diseases (inflammatory bowel disease, gastrointestinal tumors, functional gastrointestinal disorders, etc.)	82	73.21%
Digestive Endoscopic Interventions	32	28.57%
Other	6	5.36%
Number of valid responses to this question	112	

5. Years of clinical experience: [Single-choice question]

Options	Subtotal	Percentage
<5 years	30	26.79%
5–10 years	37	33.04%
11–20 years	31	27.68%
>20 years	14	12.5%
Number of valid responses for this question	112	

6. How often do you currently review or interpret abdominal CT reports on average per week: [Single-choice question]

Options	Subtotal	Percentage
Almost every day	64	57.14%
3–4 times a week	28	25%
1–2 times per week	18	16.07%
Rarely	2	1.79%
Number of valid responses to this question	112	

Part 2: Awareness and Overall Views on Phased Array CT

7. Before participating in this survey, what was your level of familiarity with “phased array CT” technology? [Single-choice question]

Options	Subtotal	Percentage
Never heard of it	46	41.07%
Have heard of the name, but am not familiar with its principles and advantages	56	50%
Have some understanding and know the main differences from traditional CT	10	8.93%
Very familiar; have read relevant technical literature or reports	0	0
Number of valid responses to this question	112	

8. After learning about its "micrometer-level spatial resolution" and "millisecond-level temporal resolution," what do you think is the overall potential impact of phased-array CT on the diagnosis and treatment of digestive system diseases? [Single-choice question]

Options	Subtotal	Percentage
Revolutionary; it will completely transform existing diagnostic and treatment pathways	25	22.32%
Important, capable of significantly improving the diagnostic accuracy for certain diseases	67	59.82%
Limited; helpful only for a few specific conditions	7	6.25%

Uncertain/difficult to determine	13	11.61%
Number of valid responses to this question	112	

Part 3: Potential Clinical Applications (Based on your clinical experience, please evaluate the application potential and demand for phased-array CT in the following specific digestive system diseases or scenarios. Please rate on a scale of 1 to 5)

A. Liver Diseases

A1. Early detection and differentiation of microhepatocellular carcinoma (<1 cm) in the context of liver cirrhosis [Rating scale question]

Average score for this question: 4.29

Option	Subtotal	Percentage
Very Low Potential/No Demand	1	0.89%
Low potential	2	1.79%
Moderate potential	5	4.46%
High potential	59	52.68%
Very high potential / Urgent demand	45	40.18%
Number of valid responses to this question	112	

A2. Early detection of liver metastases (especially post-chemotherapy assessment) [Rating scale question]

Average score for this question: 4.35

Options	Subtotal	Percentage
Very low potential/no demand	0	0%
Low potential	2	1.79%
Moderate potential	6	5.36%
High potential	55	49.11%
Very high potential / Urgent demand	49	43.75%
Number of valid responses to this question	112	

A3. Non-invasive quantitative assessment of liver fibrosis and cirrhosis [Rating scale question]

Average score for this question: 4.11

Options	Subtotal	Percentage
Very Low Potential/No Demand	1	0.89%
Low potential	5	4.46%
Moderate potential	16	14.29%
High potential	49	43.75%
Very high potential / Urgent demand	41	36.61%
Number of valid responses to this question	112	

A4. Accurate Differentiation of Benign Lesions Such as Focal Nodular Hyperplasia (FNH) and Hemangiomas [Multiple-choice question]

Average score for this question: 4.19

Options	Subtotal	Percentage

Very Low Potential/No Demand	1	0.89%
Low potential	2	1.79%
Moderate potential	12	10.71%
High potential	57	50.89%
Very high potential / Urgent demand	40	35.71%
Number of valid responses to this question	112	

B. Pancreatic Diseases

B1. Accurate Assessment of the Risk of Malignancy in Intraductal Papillary Mucinous Neoplasms (IPMN) of the Pancreas [Scale question]

Average score for this question: 4.33

Options	Subtotal	Percentage
Very low potential/no demand	0	0%
Low potential	1	0.89%
Moderate potential	12	10.71%
High potential	48	42.86%
Very high potential / Urgent demand	51	45.54%
Number of valid responses to this question	112	

B2. Detection and Staging of Early-Stage Pancreatic Cancer (<2 cm) [Multiple-choice question]

Average score for this question: 4.34

Options	Subtotal	Percentage
Very low potential/no demand	0	0%
Low potential	3	2.68%
Average potential	6	5.36%
High potential	53	47.32%
Very high potential / Urgent demand	50	44.64%
Number of valid responses to this question	112	

B3. Differential Diagnosis of Chronic Pancreatitis and Pancreatic Cancer [Multiple-choice question]

Average score for this question: 4.33

Options	Subtotal	Percentage
Very Low Potential/No Demand	0	0%
Low potential	1	0.89%
Moderate potential	13	11.61%
High potential	46	41.07%
Very high potential / Urgent demand	52	46.43%
Number of valid responses to this question	112	

B4. Detailed Assessment of the Extent of Necrosis and Vascular Complications in Acute Pancreatitis [Scale Question]

Average score for this question: 4.27

Options	Subtotal	Percentage
Very Low Potential/No Demand	0	0%
Low potential	2	1.79%
Average potential	12	10.71%
High potential	52	46.43%
Very high potential / Urgent demand	46	41.07%
Number of valid responses to this question	112	

C. Gastrointestinal Diseases

C1. Assessment of the activity, extent, and complications (e.g., fistulas) of inflammatory bowel disease (IBD) [Scale question]

Average score for this question: 4.18

Options	Subtotal	Percentage
Very low potential/no demand	0	0%
Low potential	4	3.57%
Average potential	12	10.71%
High potential	56	50%
Very high potential / Urgent demand	40	35.71%
Number of valid responses to this question	112	

C2. Localization and Risk Stratification of Gastrointestinal Stromal Tumors (GIST) and Other Submucosal Tumors [Rating Scale Question]

Average score for this question: 4.22

Options	Subtotal	Percentage
Very Low Potential/No Demand	0	0%
Low potential	2	1.79%
Moderate potential	11	9.82%
High potential	59	52.68%
Very high potential / Urgent demand	40	35.71%
Number of valid responses to this question	112	

C3. Assessment of Invasion Depth in Early Gastrointestinal Cancer (Pre-ESD/EMR) [Rating Scale Question]

Average score for this question: 4.17

Options	Subtotal	Percentage
Very Low Potential/No Demand	0	0%
Low potential	4	3.57%
Average potential	15	13.39%
High potential	51	45.54%
Very high potential / Urgent demand	42	37.5%
Number of valid responses to this question	112	

D. Functional and Dynamic Imaging

D1. Dynamic assessment of gastrointestinal (e.g., esophageal) motility [Scale question]

Average score for this question: 3.96

Options	Subtotal	Percentage
Very Low Potential/No Need	0	0%
Low potential	4	3.57%
Average potential	27	24.11%
High potential	51	45.54%
Extremely high potential / Urgent demand	30	26.79%
Number of valid responses to this question	112	

D2. Quantitative analysis of organ blood perfusion (e.g., hepatic artery/portal vein perfusion) [Rating-scale question]

Average score for this question: 4.09

Options	Subtotal	Percentage
Very low potential/no demand	0	0%
Low potential	2	1.79%
Moderate potential	18	16.07%
High potential	60	53.57%
Very high potential / Urgent demand	32	28.57%
Number of valid responses to this question	112	

E. Interventional and Surgical Planning

E1. Precise Delineation of the Ablation Field and Efficacy Assessment for Radiofrequency/Microwave Ablation of Hepatobiliary and Pancreatic Tumors [Scale Question]

Average score for this question: 4.21

Options	Subtotal	Percentage
Very Low Potential/No Demand	0	0%
Low potential	1	0.89%
Moderate potential	12	10.71%
High potential	62	55.36%
Very high potential / Urgent demand	37	33.04%
Number of valid responses to this question	112	

E2. Preoperative Vascular Planning and Postoperative Assessment for TIPS Surgery for Portal Hypertension [Multiple-choice question]

Average score for this question: 4.16

Options	Subtotal	Percentage
Very Low Potential/No Demand	0	0%
Low potential	1	0.89%
Moderate potential	17	15.18%

High potential	57	50.89%
Very high potential/urgent demand	37	33.04%
Number of valid responses to this question	112	

E3. Precise Preoperative Assessment of Vascularity and Volume of the Donor Liver in Living Liver Transplantation [Rating Scale Question]

Average score for this question: 4.14

Options	Subtotal	Percentage
Very Low Potential/No Demand	0	0%
Low potential	1	0.89%
Moderate potential	18	16.07%
High potential	57	50.89%
Very high potential / Urgent demand	36	32.14%
Number of valid responses to this question	112	

Part 4: Anticipated Challenges and Implementation Considerations

9. What do you believe are the main challenges that phased-array CT may face in clinical adoption? (Multiple selections allowed) [Multiple-choice question]

Options	Subtotal	Percentage
Excessively high equipment acquisition and operating costs	70	62.5%
Insufficient high-level evidence-based medical evidence regarding clinical efficacy	75	66.96%
Radiologists require new training and experience in interpretation	77	68.75%
The massive volume of data poses challenges for storage, transmission, and post-processing software	54	48.21%
Issues related to the standardization of inspection processes and protocols	44	39.29%
The relationship between localization and complementarity with other imaging modalities (e.g., MRI, EUS) remains unclear	55	49.11%
Other	3	2.68%
Number of valid responses	112	

10. If phased-array CT is adopted, which technology do you believe should be integrated with the massive amounts of high-resolution data it generates to maximize clinical value?* [Single-choice question]

Options	Subtotal	Percentage
Artificial Intelligence (AI)-assisted diagnostic software	60	53.57%
3D Visualization and Virtual Surgical Planning System	11	9.82%
Radiomics Analysis Platform	12	10.71%
Multimodal image fusion technology (e.g., PET/CT-MRI fusion)	27	24.11%
Other	2	1.79%
Number of valid responses for this question	112	

11. Aside from the scenarios listed above, what other exciting potential applications do you see for phased-array CT in your subspecialty? [Single-choice question]

Options	Subtotal	Percentage
Regular screening of high-risk populations (e.g., those with familial polyposis)	30	26.79%
Targeted tumor markers or inflammatory factors	21	18.75%
Applications in functional gastrointestinal disorders (e.g., irritable bowel syndrome)	13	11.61%
Integrated diagnostic systems improve the efficiency of analyzing complex diseases	44	39.29%
Other	4	3.57%
Number of valid responses to this question	112	

Part 5: Open-Ended Questions

12. What suggestions do you have for conducting clinical research on phased-array CT? Or what well-designed clinical trials would you like to see to validate its value? [Open-ended question]

This concludes the survey. Thank you once again for your valuable time and professional insights!

Average score for all questions: **67.33**