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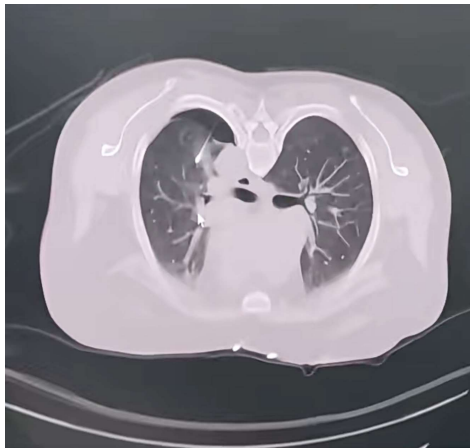
GLOBAL HEALTHCARE & BIOMEDICAL INTELLIGENCE

MLJC EXCLUSIVE | SPECIAL RESEARCH REPORT

WHEN CANCER MEETS EXTREME COLD

How Cryoablation Is Reshaping the Architecture of Cancer Treatment

**Cryoablation | Interventional Oncology | Cancer Immunology | Precision
Medicine | Biomedical Innovation**



EXECUTIVE BRIEF

Cancer treatment is undergoing a profound technological transition.

For decades, oncology has been built around three principal modalities:

Surgery



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Chemotherapy

Radiotherapy

The emergence of targeted therapies and immunotherapy subsequently transformed the systemic treatment of cancer.

Today, another highly engineered therapeutic approach is receiving renewed attention:

Cryoablation

It is often described in simple terms as “freezing cancer”.

Scientifically, however, the concept is far more sophisticated.

Cryoablation uses specialised probes, advanced imaging and controlled temperature reduction to create a precisely defined zone of extremely low temperature within or around a tumour, resulting in local destruction of malignant tissue.

The significance is therefore not simply:

Freezing cancer cells.

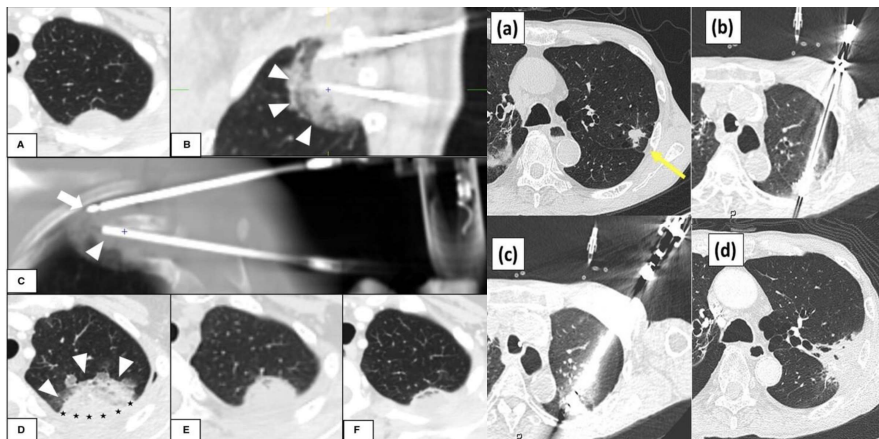
It is the development of:

PRECISION LOCAL TUMOUR DESTRUCTION

within an increasingly sophisticated framework of image-guided oncology.

I. WHAT IS CRYOABLATION?

Cryoablation is an image-guided interventional technique in which a specialised cryoprobe is positioned within a tumour.





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Rapid cooling creates an identifiable:

Ice Ball

around the treatment zone. As temperatures fall, tumour tissue undergoes a sequence of biological and structural changes, including:

Ice-crystal formation



Cellular and membrane injury



Microvascular disruption



Cell death



Tissue necrosis and subsequent biological clearance

The objective is controlled destruction of the targeted tumour while limiting unnecessary injury to surrounding healthy tissue.

This is fundamentally different from conventional open surgery.

The objective is not necessarily to remove the tumour physically through a large surgical incision, but to destroy it **in situ** through precisely controlled thermal intervention.

II. THE TECHNOLOGY IS NOT SIMPLY “COLD”

This distinction is critical.

The sophistication of modern cryoablation does not lie merely in the fact that:

Low temperatures can destroy cancer cells.

The real technological challenge is:

Where should the treatment occur?

How cold should it become?

For how long?

What is the actual treatment boundary?



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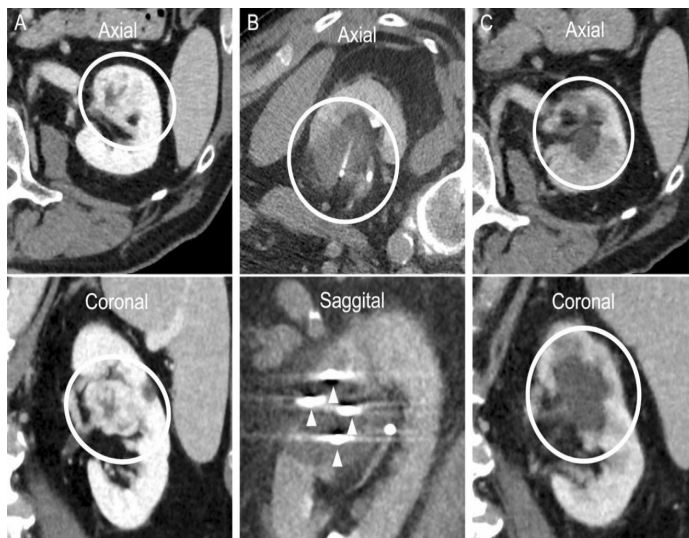
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How can surrounding normal structures be protected?

Consequently, cryoablation represents a convergence of:

IMAGING × TEMPERATURE ENGINEERING × INTERVENTIONAL PRECISION

Modern cryoablation is therefore better understood as an advanced medical engineering platform rather than simply a “freezing technique”.



III. FROM LOCAL DESTRUCTION TO IMMUNOLOGY

This may be the most strategically important area of current research.

Historically, cryoablation was primarily understood as a method of:

Local tumour destruction.

Modern oncology is asking a more sophisticated question:

What happens immunologically after tumour tissue is destroyed?

Tumours contain complex populations of:

Tumour-associated antigens

Immune cells

Cytokines



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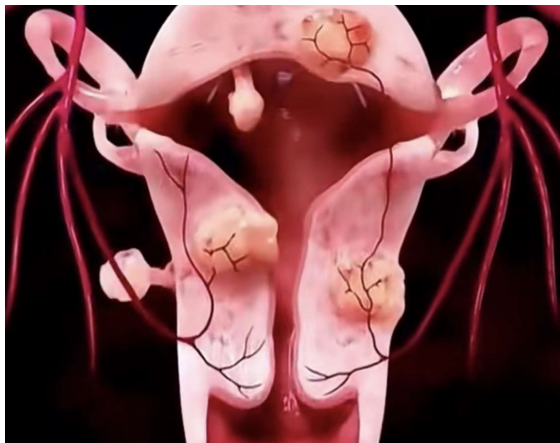
and other components of the tumour microenvironment.

When tumour tissue is disrupted, tumour-associated antigens may become available to the immune system, while the local tumour microenvironment may also be altered.

This has generated increasing interest in:

CRYOABLATION + IMMUNOTHERAPY

The concept is potentially significant because a local physical intervention may become part of a broader systemic treatment strategy.



IV. FROM LOCAL THERAPY TO LOCAL + SYSTEMIC THERAPY

The conventional cryoablation model can be represented as:

Tumour identification



Image-guided targeting



Probe placement



Controlled freezing



Local tumour destruction



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Emerging research is exploring a more complex therapeutic architecture:

Precision cryoablation



Tumour tissue disruption



Antigen release / microenvironmental change



Immune modulation



Immunotherapy



Potential systemic anti-tumour response

This raises an important scientific possibility:

Could a local therapeutic intervention contribute to a systemic anti-cancer response?

However, scientific discipline is essential here.

Cryoablation should **not** be presented as a universal cure for advanced cancer, nor should local tumour destruction automatically be interpreted as producing a systemic immune response capable of eliminating metastatic disease.

Clinical outcomes depend on multiple variables, including:

Cancer type

Disease stage

Tumour size

Tumour location

Patient characteristics

Treatment parameters

and:

Combination therapy.

The evidence base must therefore be evaluated indication by indication.



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V. WHY CHINA DESERVES CLOSE ATTENTION

China's significance in this field should not be reduced to the statement that Chinese hospitals are "using freezing technology".

The more important development is the emergence of an increasingly integrated:

INTERVENTIONAL ONCOLOGY ECOSYSTEM

bringing together:

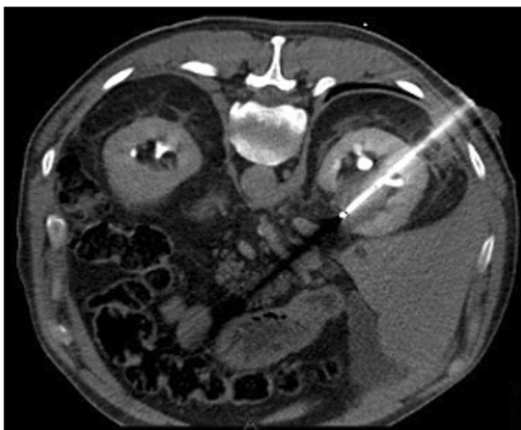
- **Medical imaging**
- **Image-guided intervention**
- **Cryoablation technology**
- **Tumour biology**
- **Immunotherapy**
- **Artificial intelligence**
- **Clinical research**

This convergence places cryoablation within a much larger field:

PRECISION INTERVENTIONAL ONCOLOGY

The strategic opportunity therefore extends beyond a single device or treatment modality.

It concerns the development of an integrated clinical platform.





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VI. MLJC STRATEGIC VIEW

MLJC does not believe the future of oncology will be determined by a single “best” treatment.

Instead, the direction of travel is increasingly toward:

MULTI-MODAL ONCOLOGY

A future treatment architecture may increasingly integrate:

AI-assisted imaging



Precision tumour localisation



Image-guided intervention



Cryoablation or other focal therapies



Targeted therapy



Immunotherapy



Longitudinal imaging



Recurrence and risk monitoring

The resulting system is no longer simply a collection of individual treatments.

It becomes:

A PRECISION ONCOLOGY ECOSYSTEM



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VII. WHY THIS MATTERS STRATEGICALLY

The significance of cryoablation lies beyond the technology itself.

It reflects a broader transformation in oncology:

From broad-spectrum treatment

towards

precision intervention

From:

single-modality treatment

towards

multi-modal therapeutic strategies

From:

local tumour destruction

towards research into:

local intervention + systemic immune modulation

And ultimately:

from treating a tumour as a physical mass

towards understanding and managing:

THE BIOLOGY OF THE TUMOUR MICROENVIRONMENT

(a) Probe advancement into lesion



(b) Probe placement into lesion





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VIII. THE NEXT FRONTIER: PRECISION × BIOLOGY × INTELLIGENCE

MLJC identifies a broader convergence that deserves long-term attention.

The future of oncology may increasingly be shaped by the intersection of:

Artificial Intelligence

×

Medical Imaging

×

Interventional Oncology

×

Biomaterials

×

Immunotherapy

×

Precision Medicine

Together, these technologies could contribute to:

NEXT-GENERATION ONCOLOGY INFRASTRUCTURE

The strategic question is therefore no longer simply:

How do we destroy a tumour?

It is increasingly becoming:

How precisely can we intervene, how intelligently can we monitor the response, and how effectively can multiple therapeutic mechanisms work together?

IX. THE MLJC QUESTION

MLJC therefore frames the central scientific question differently.

Not:

“Can cancer be frozen?”

But:

“Can precisely controlled local tumour destruction become an integral component of systemic cancer therapy?”



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This is a much more meaningful question for the international oncology community.

It moves the discussion away from sensationalism and toward:

clinical evidence

tumour biology

technology validation

patient selection

combination therapy

and:

long-term outcomes.

X. MLJC | JY HCG CONCLUSION

The significance of cryoablation is not simply that:

Cold can kill cancer cells.

Its deeper significance is that:

PRECISION MAY CHANGE THE ARCHITECTURE OF CANCER TREATMENT.

Oncology is increasingly moving:

from broad intervention

to

precision localisation;

from

single-modality treatment

to

multi-modal therapy;

from



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local tumour control

to research into

local intervention combined with systemic immune mechanisms;

and from simply:

treating the disease

towards:

UNDERSTANDING AND MANAGING TUMOUR BIOLOGY.

Cryoablation is only one component of this transition.

The larger transformation is the convergence of:

PRECISION × BIOLOGY × INTELLIGENCE

These three forces may increasingly define the next generation of cancer medicine.



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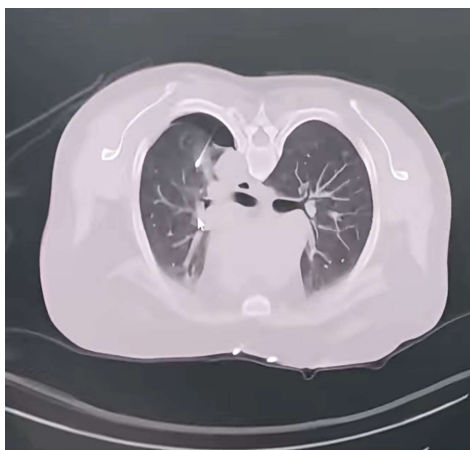
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MLJC EXCLUSIVE | SPECIAL RESEARCH

WHEN CANCER MEETS EXTREME COLD

冷冻如何重新定义肿瘤治疗：从局部消融，到精准肿瘤学的下一阶段

**Cryoablation | Interventional Oncology | Cancer Immunology |
Precision Medicine | Biomedical Innovation**



EXECUTIVE BRIEF

癌症治疗正在经历一个重要的技术转变。

过去几十年，肿瘤治疗主要围绕：

切除

化疗



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放疗

展开。

随后，靶向治疗与免疫治疗改变了肿瘤治疗的系统性逻辑。

而今天，一项看似古老、实际上高度工程化的技术正在获得新的战略关注：

Cryoablation

冷冻消融。

它不是简单意义上的“把癌症冻住”。

它真正代表的是：

利用影像引导和精准温度控制，在肿瘤内部建立受控低温区域，以局部破坏肿瘤组织。

这使癌症治疗从单纯的：

“杀死癌细胞”

进一步走向：

“精准控制肿瘤所在的生物微环境。”

一、冷冻消融究竟是什么？

冷冻消融通常通过特殊冷冻探针进入肿瘤组织。

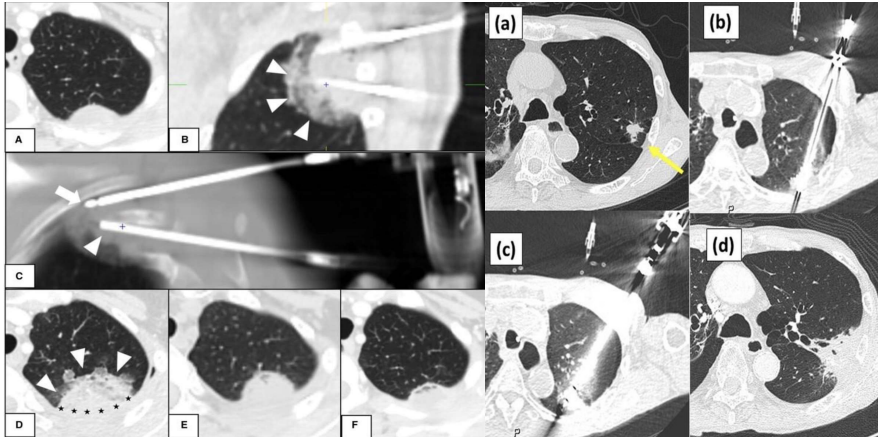


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探针在局部形成低温区域，并形成可通过影像观察的：

Ice Ball | 冰球

肿瘤组织经历快速降温后，会出现：

冰晶形成



细胞膜及细胞器损伤



微血管损伤



细胞死亡



坏死及后续组织清除

最终达到：

局部肿瘤控制。

这与传统手术最大的区别之一在于：

它不一定需要通过大范围切开组织来完成局部肿瘤破坏。



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二、但真正值得关注的不是“冷”

这是 MLJC 认为必须纠正的一个公众认知。

冷冻消融的真正科技含量并不在：

“低温能够冻死癌细胞。”

而在于：

精准在哪里冻。

冻到什么程度。

冻多久。

如何保护周围正常组织。

如何通过影像实时观察治疗边界。

因此，它实际上是：

Imaging + Temperature + Interventional Precision

即：

医学影像

×

温度工程

×

介入精准操作

的综合技术。

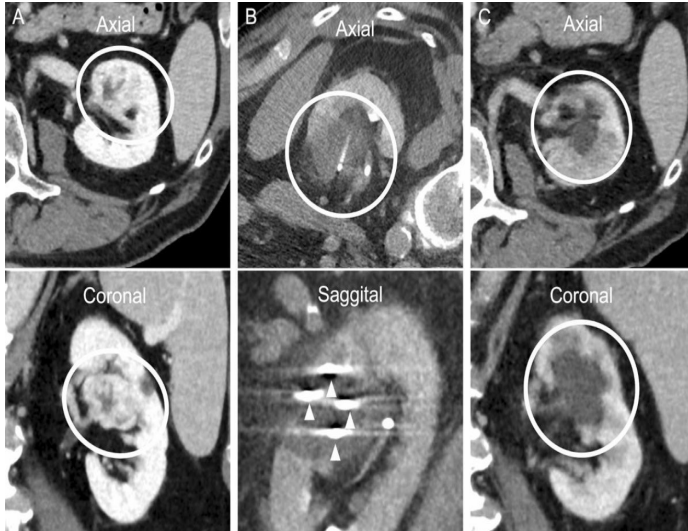


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三、冷冻消融正在进入一个新的研究阶段

过去对冷冻消融的理解主要是：

局部物理性摧毁肿瘤。

而现代肿瘤学开始提出更复杂的问题：

当肿瘤细胞被破坏之后，人体免疫系统会发生什么？

肿瘤组织中存在大量：

肿瘤相关抗原

以及复杂的：

免疫微环境。

冷冻造成的肿瘤组织破坏可能释放部分肿瘤相关抗原，并改变局部免疫环境。



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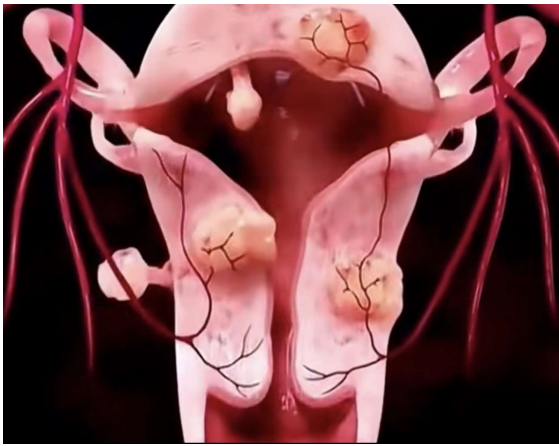
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因此，一个越来越受到研究关注的方向是：

Cryoablation + Immunotherapy

冷冻消融 + 免疫治疗



四、从“局部治疗”走向“局部 + 全身”

这是整个领域最值得关注的研究逻辑之一。

传统冷冻消融：

发现肿瘤



精准穿刺



局部冷冻



肿瘤组织破坏



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而未来联合治疗的研究逻辑可能进一步成为：

精准冷冻



肿瘤抗原释放 / 微环境改变



免疫系统调节



免疫治疗



系统性抗肿瘤反应

这意味着：

一个局部治疗手段，可能成为系统性治疗体系的一部分。

但这里必须保持科学严谨：

这仍然属于正在研究和发展的治疗策略。

不能简单解释为：

“冻掉一个肿瘤，就能够让免疫系统杀死全身所有癌细胞。”

临床疗效取决于：

癌症类型

肿瘤分期

肿瘤位置

肿瘤大小

患者免疫状态

冷冻方案



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以及：

联合治疗方案。

五、中国真正值得关注的地方

中国在这一领域的重要性，并不只是“有医院在使用冷冻技术”。

真正值得观察的是中国正在形成的：

介入肿瘤生态系统

包括：

医学影像

穿刺导航

冷冻消融设备

局部治疗

肿瘤免疫

AI 辅助诊疗

临床研究

这意味着冷冻消融正在从一个单独的治疗工具，逐渐进入：

Precision Interventional Oncology

精准介入肿瘤学

的大框架。

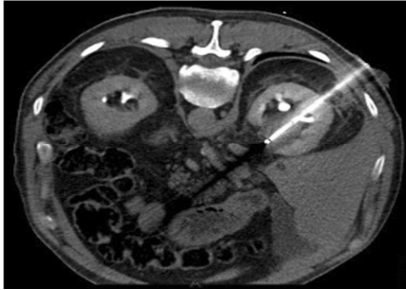


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六、MLJC 的一个重要判断

未来肿瘤治疗可能不会存在所谓的：

“唯一最佳治疗方法”。

相反，越来越可能形成：

Multi-Modal Oncology

多模式肿瘤治疗。

例如：

AI 影像识别

↓

精准定位

↓

局部消融

↓

靶向治疗

↓

免疫治疗

↓

动态监测

↓

复发风险管理



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最终形成一个更加复杂的：

Precision Oncology Ecosystem

精准肿瘤医疗生态系统。

七、为什么这件事情具有战略价值？

因为癌症治疗正在从：

Disease Destruction

疾病破坏

逐渐走向：

Disease Management

疾病管理

再进一步走向：

Biological Precision

生物学精准控制。

冷冻消融只是其中一个技术节点。

真正的大趋势是：

越来越多治疗技术正在尝试精准作用于肿瘤，同时尽可能降低对正常组织的损伤。



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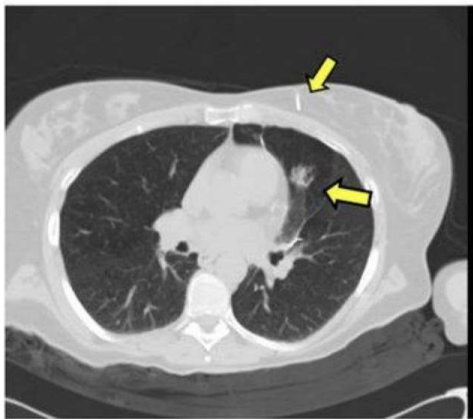
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这与：

精准医学
介入医学
免疫医学
人工智能

正在形成交叉。

(a) Probe advancement into lesion



(b) Probe placement into lesion



八、MLJC | JY HCG 战略观察

我们认为，未来十年肿瘤治疗最值得关注的，不只是某一种新药。

而是：

治疗平台的融合。



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未来真正具有战略价值的医疗体系可能是：

AI

×

Imaging

×

Interventional Technology

×

Biomaterials

×

Immunotherapy

×

Precision Medicine

形成：

Next-Generation Oncology Infrastructure

下一代肿瘤医疗基础设施。

九、一个更值得关注的问题

因此，MLJC 并不把这项技术简单定义为：

“中国可以把癌症冻死。”

这样的表达虽然容易传播，却并不符合国际医学研究的标准。

我们更愿意提出一个更严谨的问题：

Can precisely controlled local tumour destruction become an integral component of systemic cancer therapy?



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精准控制的局部肿瘤破坏，能否成为系统性癌症治疗体系的重要组成部分？

这才是值得全球肿瘤医学界持续研究的问题。

十、MLJC | JY HCG 独家判断

冷冻消融的真正意义，不在于：

Cold kills cancer.

而在于：

Precision changes the treatment architecture.

精准技术正在改变肿瘤治疗的架构。

从：

大范围治疗

走向：

精准定位

从：

单一治疗

走向：

多模式联合



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从：
局部肿瘤控制

走向：
局部治疗与全身免疫的协同研究

从：
治疗疾病

走向：
管理肿瘤生物学。

MLJC FINAL VIEW

癌症治疗的下一场革命，未必来自更强烈的“杀伤”。

它可能来自更精准的控制。

冷冻消融只是这个转变中的一个技术节点。

真正值得关注的是：

Precision × Biology × Intelligence

精准 × 生物学 × 智能

三者正在重新定义未来肿瘤医学。