

Review

Ethical Issues in Embryo Ownership Cases: A Comprehensive Narrative Review

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Abstract

Objective: This review analyzes ethical and legal conflicts surrounding cryopreserved embryo ownership, with a focus on divergences between judicial rulings and regulatory frameworks in China and other jurisdictions. **Mechanism:** We conducted a systematic narrative review of court cases, legislation, and scholarly literature to examine how disputes are adjudicated and reasoned across jurisdictions. **Findings in Brief:** While regulations often restrict embryo disposition to licensed medical institutions, courts increasingly grant ownership-like rights to patients, particularly in posthumous and post-divorce scenarios, emphasizing genetic continuity, prior consent, and emotional solace. This trend challenges standardized assisted reproductive technology (ART) governance frameworks. **Conclusions:** A coherent governance framework must balance individual reproductive autonomy, offspring welfare, and public interest through clearer legislation, multi-tiered oversight mechanisms, and inclusive ethical deliberation.

Keywords: embryo research; ownership; embryo disposition; ethics

1. Introduction

The ownership of cryopreserved embryos represents a critical intersection of ethics, law, and reproductive medicine with global relevance. As assisted reproductive technologies (ARTs) advance, disputes over control of cryopreserved embryos, whether by patients, clinics, or the state, reveal fundamental tensions between individual autonomy, societal values, and the protection of potential life. Although many countries have established regulatory frameworks, judicial rulings often diverge in practice, creating legal fragmentation and ethical uncertainty. This review examines these tensions through a comparative lens, focusing on China's evolving jurisprudence as a case study of how courts navigate the intersection between rigid regulations and humanistic considerations. By synthesizing recent case law and international models, this paper aims to inform the development of more coherent and ethically grounded governance systems for ART worldwide [1,2].

Embryo ownership is a multifaceted legal issue intersecting ethics, law, and medicine. Many Chinese court decisions conflict with former Ministry of Health regulations. Because each embryo may develop into a new life post-transfer, disputes must consider the rights of potential offspring, encompassing genetic, bioethical, and sociopolitical dimensions, including child welfare and broader public interest considerations. This study reviewed court rulings from the past decade and reexamined China's contemporary understanding of disputes involving ownership of cryopreserved embryos. This legal paradox underscores a fun-

damental tension between regulatory rigidity and judicial pragmatism in China's reproductive governance. Analysis of rulings from 2015 to 2024 revealed three emergent judicial doctrines: ① Genetic Continuity Priority: Courts increasingly recognize embryos as carriers of potential life rather than mere medical waste. In a 2023 verdict, Nanjing Intermediate Court permitted a widow to implant embryos created with her deceased husband, citing Article 16 of China's Civil Code ("protection of inheritance rights of posthumously conceived offspring"), representing a deliberate departure from the 2001 Human Assisted Reproductive Technology Regulations, which contained no such provisions. ② Dynamic Interpretation of Spousal Consent: Landmark cases (e.g., Beijing No.3 Intermediate People's Court, 2021) established that signed pre-treatment agreements between spouses constitute binding contracts, even after the death of one spouse. This approach aligns with global trends like Israel's Posthumous Reproduction Law but challenges China's traditional kinship-centric family law system. ③ Public Interest Safeguards: Judges contextualize embryo disputes within broader public interest frameworks, including family integrity and demographic values, as part of statutory interpretation.

Although many countries have established regulatory frameworks, judicial rulings often diverge in practice, creating legal fragmentation and ethical uncertainty (Table 1). These trends signal a gradual evolution in which China's judiciary is developing a context-specific judicial approach to embryo disputes that selectively integrates international



Table 1. Comparative overview of global embryo legislation models.

Aspect	Strict Protection Model (Germany/Italy)	Autonomy-Based Model (UK/Canada)	Commercialization Model (Select US States)	State-Regulated Model (China/France)
Legal Status of Embryo	Potential life	Special biological material	Property/contractual object	Regulated biological resource
Disposition Rights	Mutual consent required; No unilateral decisions	Written consent from both parties; Withdrawable	Determined by prior agreement	Controlled by medical institutions/state
Embryo Destruction	Prohibited	Allowed (with mutual consent)	Subject to agreement/state law	Highly restricted
Embryo Research	Banned or severely limited	Permitted (≤ 14 days, government-approved)	Permitted in some states (private funding)	Limited approval under state oversight
Commercialization	Prohibited	Prohibited	Allowed (research use)	Prohibited

Note: Based on legislative analysis of representative jurisdictions (Germany/Italy/UK/Canada/Select US States/China/France).

norms while operating within the country's existing civil law framework.

In this review, 'embryo ownership' refers specifically to the legal recognition of control over cryopreserved embryos, encompassing custody (physical possession), disposition rights (decisions regarding use, donation, or destruction), and decisional authority (who may exercise such rights). This is distinguished from debates on moral status (whether embryos are 'persons', 'property', or 'potential life'), which inform but do not determine legal ownership.

2. Methods

This narrative review employed a systematic search and selection process to identify relevant legal cases, legislation, and scholarly publications.

Search Strategy: Chinese court rulings (2015–2024) were retrieved from the China Judgments Online database using the keywords: "cryopreserved embryo", "embryo ownership", and "assisted reproduction". International sources were identified via PubMed, Google Scholar, Westlaw, and HeinOnline using terms: "embryo disposition", "posthumous reproduction", "ART regulations", and "embryo law".

Inclusion Criteria: cases and laws explicitly addressing embryo ownership, disposition rights, or ethical governance in ART.

Exclusion Criteria: editorials, non-peer-reviewed commentaries, articles not available in English or Chinese, and cases unrelated to ownership disputes.

Analysis: qualitative content analysis was applied to extract ruling patterns, ethical reasoning, and legal principles. Descriptive frequencies of case outcomes were calculated to identify trends. No inferential statistical tests were performed.

3. Ethical Analysis

The ethical dilemma of embryo ownership revolves around balancing three core principles:

1. **Individual Autonomy:** The rights of gamete providers to control reproductive outcomes, including posthumous use, based on prior informed consent.

2. **Offspring Welfare:** The imperative to protect the future child's psychosocial and legal interests, a principle invoked in rulings that deny embryo use in contexts deemed detrimental to child well-being.

3. **Public Interest:** Societal objectives such as maintaining family integrity, preventing commercialization, and aligning with national population policies.

In China, courts increasingly engage in a dynamic balancing of these principles. For example, in a 2023 Nanjing case, the court permitted posthumous embryo transfer by prioritizing the deceased husband's documented consent and the widow's autonomy, while also invoking the Civil Code's protection of "posthumously conceived offspring", reflecting an integration of individual and offspring-centered considerations within the national legal framework.

4. Core Differences in Human Embryo Ownership Legislation Across Global Jurisdictions

The core differences in global legislation on human embryo ownership revolve around several key points of contention: ① legal status of embryos: whether embryos are classified as "property", "potential life", or "special biological material". ② allocation of disposal rights: who holds the authority to decide on freezing, destruction, donation, or use in research (gamete providers, medical institutions, or the state). ③ research restrictions: whether embryo-related research (e.g., gene editing, stem cell research) is permitted. ④ cross-border disputes: conflicts arising over embryo ownership in transnational assisted reproductive contexts [3,4].

5. Major Legislative Models and Representative Countries

5.1 Potential Life Model (Strict Protection)

Core stance: embryos are accorded moral status from fertilization onward, warranting special protection.

Representative jurisdictions: ① Germany: The Embryo Protection Act prohibits embryo destruction and non-medical research. Gamete providers hold joint disposition rights, and embryos must be destroyed if one party objects to their use after divorce or separation. ② Italy: laws initially recognized embryos as “rights-bearing subjects” (later partially amended), prohibiting embryo freezing, selection, or destruction, with implantation as the only permitted option. Limited embryo freezing was later allowed, but neither spouse may unilaterally decide disposal. ③ Catholic-influenced states (e.g., Poland, Ireland): religious doctrine has contributed to strict restrictions on embryo manipulation, including selective reduction.

5.2 Special Biological Material + Autonomy Model (Balanced Approach)

Core stance: Embryos were depersonalized but not treated as ordinary property; disposition rights primarily rested with gamete providers.

Representative jurisdictions: ① United Kingdom (UK): The Human Fertilization and Embryology Act required written informed consent from both parties for embryo use. Consent withdrawal precluded further use. Embryo research (≤ 14 days) required government approval. ② Canada: The Assisted Human Reproduction Act prohibited embryo trade and required mutual consent for embryo disposal. Research adhered to ethical guidelines (e.g., no cloning). ③ Australia: legislation varied by state but generally required joint spousal decisions on embryo fate (destruction, donation, or research). Commercial surrogacy and embryo sales were prohibited.

5.3 Contractual Freedom + Property Rights Model (Market-Oriented)

Core stance: Embryos were treated as property-like or contractual objects, with pre-existing agreements prioritized.

Representative jurisdictions: ① United States (US): no federal law existed. At the state level, approaches varied. California upheld pre-existing agreements (e.g., post-divorce embryo disposal per contract); New York favored the rights of the non-procreative party; Louisiana deemed embryos as juridical persons, prohibiting destruction. Private reproductive sector was well developed, allowing embryo sales (research) and commercial surrogacy (in some states). ② Israel: surplus embryos could be donated for research (government-approved), with policies favoring reproductive rights.

5.4 State-Dominated Regulation Model

Core stance: National laws strictly define permissible embryo use to prevent ethical violations.

Representative jurisdictions: ① China: The Human Assisted Reproductive Technology Standards (2003) explicitly prohibit embryo trade and commercial surrogacy. Cryopreserved embryos must be stored in licensed facilities, and their posthumous or post-divorce disposition remains legally ambiguous. Following the He Jiankui gene-editing incident, the Biosecurity Law (2021) further tightened controls on human embryo research, requiring approval from institutional ethics committees and national-level oversight. Article 1007 of the Civil Code (2021) prohibits the trade of human cells, tissues, organs, and human remains, establishing the foundational non-commercial principle applicable to all human biological materials including embryos; Article 1009 further stipulates that medical and scientific research activities involving human genes and human embryos must comply with laws, regulations, and relevant national provisions, and must not violate ethical principles or harm public interests, reinforcing formal ethical and regulatory boundaries for embryo governance. ② France: embryos are classified under “public order” (ordre public), precluding sale, purchase, or unilateral destruction. The Bioethics Law (1994, updated 2021) stipulates that embryos may be used only for reproductive purposes by the couple that created them. In the event of the death of one partner, the embryos must be destroyed unless both had previously consented to posthumous use, a provision rarely invoked in practice. Embryo research is permitted only under strict authorization from the Agence de la Biomédecine and is limited to projects of major scientific or medical interest.

5.5 Religious Law-Dominant Model

Core stance: Embryo governance is derived directly from religious doctrines, often attributing to embryos a moral status akin to personhood from conception.

Representative jurisdictions: ① Saudi Arabia: under Sharia law, embryos are regarded as “potential life” once formed. The 2022 Saudi Guidelines on Assisted Reproduction permit ART only for married couples and forbid embryo destruction, donation, or research involving embryo damage. Surplus embryos must be cryopreserved indefinitely, reflecting the Islamic principle of “respect for potential personhood” (hifz al-nasl). Clinics are required to obtain fatwa (religious ruling) approval for any novel reproductive procedures. ② Iran: similarly, ART is permitted within marriage; however, post-formation embryos may not be deliberately destroyed. The Embryo Protection Act (2003) allows embryo cryopreservation for future use within marriage but prohibits donation to third parties. Research on supernumerary embryos is exceptionally permitted only when the embryos are considered non-viable, and only with the consent of both spouses, subject to oversight

Table 2. Trends in Chinese Embryo Ownership Cases (2015–2024).

Case Type	Number of Cases	Ruled for Patient	Ruled for Hospital	Key Reasoning for Patient Victory
Widow seeking transfer	22	18	4	Fulfillment of spousal intent, prior consent
Parents seeking embryo return	1	1	0	Genetic legacy, emotional solace
Couple vs. hospital	57	53	4	Life-ethical connection, right to terminate custody

Note: Data sourced from China Judgments Online; n = 80 publicly available rulings. Full case-level metadata and coding criteria are provided in **Supplementary Table 1**.

by the National Ethics Committee for Biomedical Research. © Vatican (Holy See): Catholic teaching, as articulated in *Donum Vitae* (1987) and *Dignitas Personae* (2008), holds that human embryos possess full moral status from conception. All forms of *in vitro* fertilization (IVF), embryo cryopreservation, embryo research, and intentional embryo destruction are considered morally illicit. The only licit means of procreation is within marriage through natural conjugal acts, placing the Vatican at the most restrictive end of the global regulatory spectrum.

5.6. Domestic Embryo Ownership Disputes in China (2015–2024)

Table 2 delineates the judicial trends in embryo ownership disputes within China from 2015 to 2024. Based on publicly available rulings from the China Judgments Online database (n = 80), these cases predominantly fall into three distinct categories: (1) widows seeking embryo transfers (22 cases, with 18 ruled in favor of the patient and 4 in favor of the hospital); (2) parents seeking the return of embryos (1 case, ruled in favor of the patient); and (3) disputes between couples and hospitals (57 cases, with 53 ruled for the patient and 4 for the hospital). The core judicial reasoning underpinning patient victories primarily involves honoring the deceased spouse’s prior intent and consent, preserving genetic lineage and emotional solace, and upholding life-ethical connections alongside the right to terminate custody. Overall, domestic Chinese judicial practice demonstrates a pronounced tendency to safeguard patients’ embryonic rights. It is important to note that this domestic framework is fundamentally distinct from cross-border disputes with respect to applicable law, personal jurisdiction, and ethical standards; consequently, these two categories of cases should be analyzed separately to avoid conflation. Full case-level details, including court names, judgment years, case numbers, core reasoning, and study coding criteria, are provided in **Supplementary Table 1** to ensure transparency and reproducibility of the analysis.

6. Trends and Challenges in Global Embryo Legislation

Although global embryo legislation exhibits distinct models, including strict protection, autonomy-based equilibrium, and market-based contracts, the cutting-edge challenges they collectively face are increasingly convergent. First, the pace of advances in reproductive technology is

outstripping legal revision cycles. For instance, the emergence of gene editing technologies [e.g., clustered regularly interspaced short palindromic repeats (CRISPR)] and synthetic embryo models is fundamentally disrupting the traditional paradigm that anchors moral status at “conception”, compelling nations to reevaluate their regulatory boundaries for embryo research [5]. Second, cross-border reproductive tourism continues to exploit legal disparities among countries, generating complex conflicts of international jurisdiction and applicable law, and exposing the limitations of regulatory frameworks based purely on national sovereignty [6]. Finally, judicial debates regarding women’s unilateral right to dispose of embryos are intensifying, reflecting the underlying tension between “reproductive autonomy” and “potential life interests”, as well as issues of contractual enforceability. Comparative legal research indicates that future legislative trends will no longer involve selecting a single existing model, but rather shift toward “contextualized governance”, applying differentiated rights allocations and ethical review standards at distinct decision points (e.g., creation, cryopreservation, divorce, death, and research) [7]. This approach demands greater legal flexibility and foresight, accommodating scientific uncertainty while seeking a dynamic equilibrium between the protection of vulnerable parties (including potential offspring) and respect for individual autonomy.

6.1 Technology-Forcing Legal Reforms

Emerging technologies like CRISPR-based gene editing and synthetic embryo models consistently challenge established ethical frameworks, compelling governments to reassess outdated laws.

6.2 Globalization-Induced Conflicts

Cross-border “fertility tourism” (e.g., traveling to the US to preserve embryos and circumvent home-country destruction mandates) frequently exploits legislative gaps, raising jurisdictional disputes.

6.3 Battles Over Bodily Autonomy

Intense legal debates have centered on whether women retained unilateral rights to use or destroy embryos. US state-level rulings have increasingly favored the protection of “procreative choice” (e.g., 2023–2024 court cases in Arizona and Texas).

National legislation historically attempted to balance scientific progress, reproductive rights, bioethics, and religious values. However, these tensions are expected to intensify with advancements in reproductive artificial intelligence (AI) and genome engineering, further complicating international consensus [8].

7. Profile of Cryopreserved Embryo Retrieval Cases in Chinese Courts

The adjudication of frozen embryo disputes by Chinese courts has shown a clear track of evolution from rigid application of departmental regulations to a more flexible “mixed jurisprudence” that incorporates human considerations. Early judgments (e.g., the first-instance Yixing case in 2014) strictly followed the premise of “married couples” requirement set out in the technical specifications issued by the former authorities, denying the inheritance of embryos or the right to request the return [9]. However, the emerging judicial theory reflected in the second-instance Yixing case marked a shift in interpretation. Its core was the redefinition of embryo as a special category associated with “genetic continuity” and “emotional significance”, rather than as simple medical waste or purely contract objects. Recent studies have suggested that this change reflects efforts by Chinese judges to reconcile the profound tension between the rigid requirements of state regulation and the increasingly strong public demand for reproductive autonomy in practice. Through a systematic analysis of judgments issued between 2015 and 2024, scholars have observed that courts increasingly invoke the general principles of the Civil Code concerning human dignity, protection of marriage and family, as well as legal principles such as “the closest interested party”. These principles are applied to reconcile and supplement specific provisions of administrative regulations, thereby granting rights of custody and disposition of embryos to widowed spouses or next of kin. Underlying this evolving judicial interpretation is not only a response to the strong societal emphasis in China on blood-line continuity and family values, but also the gradual development of a nuanced legal characterization of embryos as situated between “potential life” and “special biological property” [10,11] (Table 2).

The court of first instance determined that: ① embryos constituted “life-bearing entities” unsuitable for inheritance or transfer; and ② the intent to procreate became void upon the donors’ deaths. Accordingly, the parents’ claim was rejected. By contrast, the appellate court ruled that: ① medical institutions had contractual obligations precluding unilateral posthumous embryo disposal; ② embryos embodied the deceased’s genetic legacy, thereby establishing parental kinship; ③ the parents represented the “closest stakeholders” with a vested interest in embryo disposition; and ④ embryos provided bereaved parents with emotional solace and memorial value. Consequently, the hospital was ordered to release the embryos to the parents.

Two cases involved husbands claiming cryopreserved embryos following their wives’ deaths, while two others featured widows seeking embryos after their husbands’ demise. The courts ruled that: ① medical institutions should not intervene in the subsequent disposition based on presumed risks associated with embryo use; ② embryos contained genetic material and, as the closest stakeholders to these residual embryos, the claimants were entitled to custodial and dispositional civil rights; and ③ for bereaved spouses, embryos represented potential sources of grief mitigation, emotional solace, and psychosocial support. Accordingly, the courts ordered medical institutions to return the cryopreserved embryos to the surviving spouses.

Among 22 cases in which widows requested thawed embryo transfers following their husbands’ deaths, courts ruled in favor of the bereaved wives in 18 cases, ordering medical institutions to proceed with transfers based on the following findings: ① the contractual purpose of procreation remained unfulfilled, thereby granting the widow contractual enforcement rights; ② the deceased husband’s prior written informed consent complied with informed consent requirements; ③ children raised in single-parent households demonstrated comparable well-being to those naturally conceived, with no empirical evidence showing that ART-derived offspring faced disproportionate legal or developmental disadvantages; and ④ widows were not defined as single women under ART Technical Norms. However, four cases (in Shandong, Fujian, and Guangxi provinces) denied the transfer requests, citing the following grounds: ① institutional consent forms required dual spousal signatures for the procedure; ② service contracts were intended to facilitate the possibility of fertility rather than guarantee live birth; ③ the plaintiff’s status as a widow constituted legal singlehood [12]; and ④ deliberately creating fatherless children violated the “Posterity Protection Principle” and the “Social Welfare Doctrine”, as it was deemed to potentially compromise the offspring’s psychosocial stability.

Courts adjudicated 57 cases in which couples demanded the return of cryopreserved embryos from medical institutions. In 53 cases, the embryos were ordered to be returned, based on: ① the existence of a life-ethical connection between couples and embryos, granting them custodial and dispositional civil rights; and ② the couples’ entitlement to terminate embryo custody agreements with medical institutions. However, four cases (3 in Shanghai, 1 in Hangzhou) were denied on the following grounds: ① the signed contracts constituted comprehensive medical service agreements (covering IVF, embryo culture, and transfer), in which cryopreservation was ancillary; although couples retained regulatory rights, direct possession was prohibited; ② Article 1007 of the Civil Code prohibits trade in human cells, tissues, organs, and remains, while Article 1009 establishes ethical and regulatory constraints on activities involving human embryos; together, these provisions warrant restrictions on unregulated individual disposition of em-

bryos given their developmental potential; ③ ART regulations mandated that embryo preservation may only occur in state-approved facilities; and ④ embryos qualify as human genetic resources under the Human Genetic Resources Management Regulations, requiring compliance with state-authorized storage requirements [13,14].

8. Embryo Cryopreservation and Use: Bioethics-Based Management of ART

Reproductive medicine differs fundamentally from other medical fields, as its therapeutic outcome is the birth of offspring, whose welfare demands paramount consideration. Even couples seeking fertility treatment cannot unilaterally determine the fate of embryos; instead, medical professionals must participate in safeguarding potential offspring under the principle of child-first priority. Unlike conventional medical technologies or drugs, which undergo animal testing, clinical trials, and phased approvals, ART involves inherent limitations prior to clinical application. Techniques such as embryo cryopreservation deviate from natural reproductive physiology, effectively requiring safety of these interventions to be evaluated through their outcomes in future generations. Concurrently, illicit embryo trading and surrogacy have flourished globally, exploiting third-party reproductive capacities and subverting established ethics, social norms, and legal frameworks. Thus, establishing ART's bioethical framework has been deemed essential to regulate reproductive medicine at its source.

In 1982, the United Kingdom pioneered global regulatory governance for human assisted reproductive technologies by establishing the Committee of Inquiry into Human Fertilization and Embryology. Chaired by Dame Mary Warnock, a distinguished moral philosopher at the University of Cambridge, the committee conducted a comprehensive cross-disciplinary review of the medical, scientific, ethical, and legal implications of emerging reproductive practices following the birth of the first *in vitro* fertilization baby in 1978. In July 1984, the committee published its seminal official report, entitled Report of the Committee of Inquiry into Human Fertilization and Embryology (universally known as the Warnock Report) (1). This landmark government document contained 64 evidence-based recommendations that established the foundational principles for the UK's Human Fertilization and Embryology Act 1990 and subsequently influenced regulatory policies for reproductive medicine in more than 50 countries worldwide. Citation: (1). Great Britain. Committee of Inquiry into Human Fertilization and Embryology. Report of the Committee of Inquiry into Human Fertilization and Embryology. London: Her Majesty's Stationery Office; 1984. Cmnd. 9314 [15]. Key provisions addressed the legal status and disposal of cryopreserved embryos: If one spouse died, embryos were assigned to the surviving partner; if both died, disposal rights defaulted to medical institutions. The UK

subsequently enacted the Human Fertilization and Embryology Act (1990), which prohibited non-compliant embryo preservation [16]. In 1991, the Human Fertilization and Embryology Authority (HFEA) was established to oversee embryo storage and use, including approvals for gamete and embryo preservation. Amendments in 2008 allowed posthumous embryo transfer if the deceased male had consented without revocation, granting resulting children the same legal status as legitimate offspring [17,18]. Other nations followed divergent approaches. Germany's Embryo Protection Act (1990) banned egg donation, surrogacy, and non-medical use of embryos. In contrast, the US has no federal-level embryo protection statute. Instead, regulatory and judicial authority over embryo governance is devolved to individual states, resulting in divergent legislative provisions and court rulings across jurisdictions [19,20,21]. For example, Florida granted full disposal rights to surviving spouses, whereas many other Western countries lacked detailed regulations.

In 2001, China promulgated the "Measures for the Administration of Human Assisted Reproductive Technology and the Measures for the Administration of Human Sperm Banks". Subsequently, in August 2003, the Ministry of Health issued revised regulations through Document No. 176, formally titled "Notice on Revising the Technical Specifications, Basic Standards, and Ethical Principles for Human Assisted Reproductive Technology and Human Sperm Banks". These documents established China's licensing system for ART and explicitly articulated fundamental bioethical principles, including the principle of protecting offspring. They stipulated that treatment was restricted to married couples; the commercial trade of gametes and embryos was strictly prohibited; and oocyte donation and surrogacy were banned as technical practices. Collectively, these regulations laid the foundation for standardized development of ART in China.

9. Ethical Dilemmas of Embryo Ownership Rights

The core ethical dilemma surrounding embryo ownership arises from the need to balance diverse and often conflicting value propositions in specific decision-making scenarios. Systematic ethical analysis frameworks are typically structured along three dimensions: individual autonomy, the best interests of the offspring, and broader public welfare. First, the reproductive autonomy and bodily integrity rights of gamete donors constitute the foundational consideration. This includes the validity of prior informed consent and the respect for donor wishes following subsequent life changes, such as divorce or widowhood [21]. Second, the principle of the "best interests of the offspring" mandates that any decision involving embryo use must carefully assess potential psychological, social, and legal risks to the future child's well-being. However, as ethicists note, predicting the postnatal interests of an embryo inher-

ently involves speculation, posing significant challenges for ethical decision-making [22]. Finally, the public interest dimension encompasses the maintenance of stable family structures, the prevention of the commercialization of human reproduction, and alignment with broader societal and population development priorities [9,23]. Within the Chinese context, balancing these three dimensions proves particularly complex: while courts acknowledge individuals' "emotional interests" in embryos and their "right to genetic continuity", they must simultaneously invoke principles of "social order and good customs" and "protection of future generations" in line with legal frameworks that prioritize traditional family structures. This dynamic equilibrium, rather than strict adherence to any single principle, defines the ethical framework governing current embryo ownership disputes in China.

The ethical governance of embryo ownership necessitates a tripartite balancing act: (1) the primacy of offspring welfare, which mandates that embryo use should not compromise the future child's psychosocial well-being; (2) respect for individual autonomy, particularly the reproductive intentions of gamete providers; and (3) alignment with the public interest, including demographic policy objectives and broader societal values. In Chinese rulings, these principles are often weighed dynamically; for instance, posthumous embryo transfer may be permitted when it aligns with the deceased's documented reproductive intent while not conflicting with national family planning objectives.

The concept of ownership in law primarily refers to property rights, encompassing possession, use, benefit, and disposal, as well as legal attribution. Healthy patient couples retain full ownership of embryos, including the right to use cryopreserved or thawed embryos [23]. However, embryos with developmental potential are not mere property. When couples holding embryo-related rights, widowed spouses, or genetically-related grandparents request the retrieval of cryopreserved embryos, the allocation of usage rights becomes an ethical dilemma. This requires collaboration among patients, medical institutions, society, and, in some cases, government authorities, guided by the ethical principle of prioritizing offspring safety and interests to mitigate potential risks [24]. Non-transferred IVF embryos are not necessarily "on the path to birth", making it impossible to define the extent of their entitlement to offspring welfare. Consequently, restrictions on the right to use cryopreserved embryos vary across jurisdictions and circumstances. In China, most court rulings have granted embryo usage rights to patients, which contradict the Regulations on Assisted Reproductive Technology Management. Medical institutions have limited authority, struggling to strictly enforce industry regulations.

Human society has historically emphasized intergenerational continuity through genetically related offspring, valuing familial kinship [25,26,27]. Widowed individuals or bereaved parents often seek access to cryopre-

served embryos—whether for retrieval or transfer—in order to achieve pregnancy and deliver a child sharing their genetic lineage [28]. ART was developed for this purpose and remains committed to it. However, compliance with China's regulations is mandatory: treatment is restricted to married couples; the commercial trade of gametes and embryos, oocyte donation, and surrogacy are prohibited—all to ensure societal order and healthy human reproduction. Legally, patients are expected to manage cryopreserved embryos within the applicable legal framework, safeguarding public morality, the rights of others, and the principle of protecting offspring health [29]. Courts have ruled that risks associated with embryo transfer and storage were borne by patients.

The superintendence of embryo usage rights poses an ethical challenge [30]. ART involves three parties: patient couples, who hold reproductive rights (to pursue happiness); donors, who are entitled to dignity and self-determination; and potential offspring, who are considered to have a "right to be thoroughly considered and treated" prior to ART—a non-negotiable right [31]. Although neither patient couples nor donors possess absolute rights, neither may infringe upon the interests of others. Unlike natural conception, the process from gametes carrying parental genetics to *in vitro* embryos requires medical institutions and ART professionals to safeguard the rights of potential offspring. They were obligated to adhere to national technical standards governing embryo preservation and use, as well as to regulate patients' rights to use embryos [30,32].

10. Conclusions

While ethical dilemmas persisted, ART-qualified medical institutions operating within a rule-of-law framework must uphold established reproductive ethical standards. Custody and clinical use of cryopreserved embryos must remain within legally authorized medical institutions under appropriate oversight to prevent regulatory violations. To operationalize these principles, a multi-tiered governance framework should be established [33].

Legally accredited ART institutions should implement strict chain-of-custody protocols for cryopreserved embryos, including standardized access authentication and auditable disposition records to prevent unauthorized transfers. For instance, Spain's National Registry of Assisted Reproduction maintains centralized, real-time records of embryo storage and disposition, a governance model that could reduce risks of mismanagement such as those documented in the 2024 Seoul fertility clinic incident [32].

Societal oversight requires transparent stakeholder engagement. Ethics review bodies with lay citizen representation (such as the citizen consultation mechanisms established under Japan's reproductive medicine regulatory framework) can conduct periodic audits of embryo storage facilities, with summarized findings made publicly available. This approach aligns with the World Health Organiza-

tion's 2023 guidance on ethical governance of health technologies, which emphasizes inclusive, participatory oversight beyond technical expert circles.

Reproductive ethics must evolve alongside technological advances. The growing prevalence of posthumous conception cases, as reflected in established jurisprudence from the European Court of Human Rights regarding reproductive autonomy after spousal death, underscores the need for clear legislative frameworks that balance individual reproductive autonomy with the contested moral status of embryos. Within China's existing regulatory system, posthumous embryo disposition is evaluated on a case-by-case basis by courts and ethics committees, with reference to prior informed consent and the principle of offspring welfare.

Ultimately, safeguarding the appropriate governance of cryopreserved embryos requires synergy between legal regulation and societal oversight. While CRISPR-mediated heritable human genome editing in embryos remains at the preclinical research stage and has not entered clinical trials involving human pregnancy in any jurisdiction, germline intervention precedents have already been set by clinically licensed technologies such as mitochondrial replacement therapy in the UK. The legal principles established by current embryo custody and governance regimes will shape whether societies can harness evolving reproductive technologies without eroding foundational ethical boundaries.

Ownership disputes over cryopreserved embryos represent a microcosm of tensions between legal, ethical, and societal values. China's judicial practice is developing a context-specific approach to reconciling these tensions through principled interpretation of general civil law provisions. However, long-term stability and systemic coherence will require support from higher-level, specialized legislation governing life science ethics. Future governance frameworks must transcend binary attributions of "ownership" and instead build comprehensive systems encompassing end-to-end technological oversight, multi-tiered ethical review, and diversified social co-governance. This includes: at the operational level, drawing on international experience (such as the UK HFEA model) to establish an enforceable embryo registration and tracking system; at the ethical level, promoting contextualized review guidelines that clarify procedures for balancing interests in scenarios such as spousal death or divorce; and at the societal level, incorporating public values into regulatory decision-making through mechanisms such as citizen juries and public consultations to enhance democratic legitimacy [34]. Only through coordinated governance across law, ethics, and society can the benefits of reproductive technologies be advanced while safeguarding fundamental ethical boundaries concerning human life.

Author Contributions

HY designed the research study. HY and LP performed the research. LP analyzed the data. Both authors

contributed to editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Not applicable.

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Conflicts of Interest

The authors declare no conflicts of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.31083/CEOG47881>.

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