A STUDY ON BIOMETRIC IDENTITY RECONCILIATION IN POST-SURGICAL TRANSPLANT FOR (PWDS) AND THE NEED FOR SOCIAL AND SYSTEMIC INCLUSION

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ABSTRACT

India's biometric identification system plays a pivotal role in recognising every Indian citizen for their distinct biometric markers (handprints, ocular scans, DNA and facial attributes). This simultaneously facilitates seamless integration across Aadhar authentication, banking services, government services, convenient travel procedures with digi yatra, immigration, health record access and simplified KYC procedures. There are nuanced conflicts that persons with disability experience due their tragic accidents that result in the loss of their sight or limbs that alter their biometric identifiers. Such individuals, when they register as transplant recipients and rebuild their lives successfully, tend to get caught in the social and systemic exclusivity of biometric authentication. In most scenarios, PWDs, on regaining functionality of their sight and limbs after groundbreaking transplant and reconstruction surgeries, experience unprecedented situations ie., their iris scans, reconstructed face and fingerprints don't match their registered records resulting in misidentifying them with their donors' records. This grey area becomes a predicament for such individuals, creating systemic obstacles hindering them to move forward with their lives. Individuals who undergo facial reconstruction surgeries following an accident, face similar setbacks, as their previous records no longer align with the features of their reconstructed face. Due to the lack of comprehensive guidelines to handle such situations in various sectors, surgeons have resorted to writing letters that are similar to disability certificates given in the cases of fatal burns and injuries by medical boards. This study emphasises the need to address two major aspects, first, establish comprehensive guidelines for cancelling or deactivating a donor's aadhar and biometric records after death and second, implementing alternative provisions to reinstate new biometric prints for those who get misidentified and inadvertently creates conflict with their donors records post-transplant and reconstructive surgeries.

Keywords: Biometric authentication, Identity conflict, Transplants, Reconstruction, Social Inclusivity, Persons with Disability

I. INTRODUCTION

In the contemporary digital ecosystem, biometric authentication has become fundamental to security and identity verification systems. While these technologies enhance security, they present unique challenges in post-transplant scenarios, particularly concerning the ethical and legal implications of biometric data inheritance. A critical grey area emerges when transplanted organs, especially hands and corneas, carry the biometric markers of deceased donors, creating an unprecedented situation where authentication systems may recognize and respond to the donor's biometric data rather than the recipient's identity. This complex scenario is further complicated by existing legal frameworks governing biometric data after death. In India, for instance, the deactivation of a deceased person's Aadhaar (biometric identification) requires family consent and formal procedures through the UIDAI. Until this deactivation occurs, transplant recipients face significant challenges as their transplanted organs continue to carry and potentially register the donor's biometric signatures. This creates a paradoxical situation where living individuals bear the biometric identity of the deceased, raising profound questions about identity ownership, privacy, and the right to digital existence. The significance of this research extends beyond technical complications, delving into critical legal and ethical territories. Current legislation inadequately addresses the transition of biometric identity in transplant cases, creating administrative hurdles for recipients who must navigate both medical recovery and identity verification challenges. The absence of standardised protocols for handling such biometric conflicts poses risks to privacy, security, and accessibility of essential services for transplant recipients. Despite the growing frequency of transplant procedures and the ubiquity of biometric authentication systems, there remains a conspicuous gap in both research and policy frameworks addressing this intersection. While medical protocols for transplants are well-established, the digital afterlife of donor biometrics and its impact on recipients' identity management remains largely unexamined. This study aims to investigate these challenges comprehensively, analysing the technical, legal, and social dimensions of post-transplant biometric authentication. It seeks to document cases where transplant recipients encounter authentication conflicts, examine existing legal frameworks governing deceased donors' biometric data, and propose policy recommendations for managing biometric identity transitions post-transplant. By examining current practices, legal gaps, and potential solutions, this study strives to contribute to developing more inclusive and ethically sound frameworks for managing biometric identity in post-transplant scenarios.

II.   OBJECTIVES

- To analyse the discrepancies faced by PWDs post-transplant surgeries.

- To evaluate the adequacy of the existing legal frameworks for deactivating Aadhar biometrics data post death.

III.   LITERATURE REVIEW

1. Current Biometric Authentication Systems

A 12-digit random number known as an Aadhaar number is provided to Indian citizens by the UIDAI ("Authority") upon completion of the Authority's verification requirements. The enrollment process is completely free and requires only a little amount of biometric and demographic information from the person wishing to enrol. Since the process of demographic and biometric de-duplication ensures uniqueness, an individual only needs to enrol for Aadhaar once, and only one Aadhaar will be generated following de-duplication. With the use of the Aadhaar identity platform's built-in capabilities of uniqueness, authentication, financial address, and e-KYC, the Indian government can now directly contact citizens to provide a range of subsidies, benefits, and services by utilising their Aadhaar number alone. Name, Date of Birth/Age, Gender, Address, Mobile Number, and Email ID are among the demographic information included in Aadhaar. The head's name, relationship, and Aadhaar number are needed for family-based enrollment. Proof of Relationship (PoR) and one parent's Enrollment ID or Aadhaar Number are required for child enrollment. Ten fingerprints, two iris scans, and a face shot are among the biometric information gathered. Current biometric authentication systems have evolved significantly, incorporating various physiological and behavioural characteristics for identity verification. However, they operate under the assumption of relatively stable and unchanging biometric markers, which creates inherent challenges for individuals who undergo significant physical changes.[1]

2. Transplant Procedures Affecting Biometric Markers

The impact of transplant procedures on biometric markers is particularly significant. Hand transplants directly affect fingerprint recognition, eye transplant affects the ocular structure ,while facial reconstruction completely alters the underlying architecture used in facial recognition systems. Even partial reconstructive surgeries can modify biometric patterns

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[1] S. M. E. Hossain and G. Chetty (2011), *Human Identity Verification by Using Physiological and Behavioural Biometric Traits, International Journal of Bioscience, Biochemistry and Bioinformatics,* Vol. 1, No. 3.

enough to cause authentication failures. The changes aren't limited to obvious physical characteristics – corneal transplants affect iris patterns, and transplant procedures can alter fingerprint patterns, making aadhaars' biometric authentication methods unreliable for post-transplant individuals as their present biometric markers will conflict with the non-deactivated donors' biometrics.[2]

3. Challenges Faced By Persons With Disabilities (Pwds) Post-Transplant Surgeries In Biometric Systems

Post-transplant individuals with disabilities face unique challenges when interacting with biometric authentication systems, particularly those that rely on physical characteristics that may have been altered by their medical procedures. This intersection of transplantation and disability creates complex barriers to access and identification.

3.1 The Aadhaar (Enrolment And Update) Regulations, 2016:

In accordance with Section 6, enrolment of individuals seeking to enrol with biometric exceptions, are provided with;

> i)   PWDs unable to provide fingerprints due to injury, or imputation can rely on their iris scans.

> ii)   Those incapable of providing any form of biometrics shall be guided by an authority for that purpose.

The second subsection highlights the ambiguity in legislation regarding individuals whose records reflect those of their deceased donors. It emphasizes on the discrepancy that, deactivating the donor's Aadhaar is the family's responsibility, hindering the transplant recipients to re-enroll their biometrics. The gap in legislation creates a dependency on the families of the deceased donors to deactivate their aadhars', this should rather be administered by the Unique Identification Authority of India (UIDAI) and the Registrar General of India can plan to implement a mechanism for deactivating Aadhaar upon the issuance of a death certificate. Once the death certificate is issued by the relevant agency, the family of the deceased will be notified, and the Aadhaar number can be deactivated following their consent rather than requiring transplant recipients to wait until the families find time.[3]

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[2] Ram Kumar, Jasvinder Pal Singh, Gaurav Srivastava (2012), *Altered Fingerprint Identification & Classification Using SP Detection & Fuzzy Classification, Advances in Intelligent Systems and Computing* Vol.
No. 236.
[3] The Aadhaar (Enrolment And Update) Regulations, 2016, *section 6.*

3.2 Fingerprint Recognition Challenges:

For transplant recipients who have undergone hand or finger transplants, fingerprint-based authentication systems pose significant difficulties. The transplanted tissues may have different fingerprint patterns from their original biometric records or their donors. Additionally, immunosuppressive medications can cause skin changes that affect fingerprint clarity.[4]

3.3 Iris and Retinal Scanning Issues:

Transplant recipients who have undergone corneal transplants face particular challenges with iris-based recognition systems. The surgical procedure alters the unique patterns of the iris that these systems rely on for identification. Similarly, individuals with ocular transplant surgeries will identify as their donors when scanned for their biometrics.

3.4 System Design and Accessibility:

The current biometric systems lack inclusive design features that accommodate various disabilities. For instance,

a) Banking Difficulties: Many banks require fingerprint verification for transactions and account access. When fingerprints don't match registered patterns or match a donor's prints leaving them perplexed, these individuals may be denied basic banking services, face lengthy verification processes, or have their accounts temporarily frozen pending investigation.

b) Travel Complications: Airport security and immigration checkpoints heavily rely on biometric verification. Changed or donor-matching fingerprints can trigger security alerts, leading to extended questioning, missed flights, and heightened anxiety during travel. International travel becomes particularly challenging when biometric passports and visas don't match current fingerprints.

c) Government Services Access: Many government services, welfare programs, and identity verification systems use fingerprint authentication. Post-transplant biometric inconsistencies can hinder access to essential services, disability benefits, and healthcare facilities.

d) Employment Challenges: Jobs requiring security clearance or biometric attendance systems may become problematic. Employees might face daily challenges proving their

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[4] Munish Kumar, Priyanka (2018), *Fingerprint Recognition System: Issues and Challenges*, ISSN: 2321-9653, Volume 6 Issue II.

identity or accessing secure areas at work.

e) Social Stigma: Repeated questioning and suspicion during routine biometric verification can lead to emotional distress and feelings of discrimination. Having to repeatedly explain their medical condition in public settings can be embarrassing and compromise privacy.

f) Documentation Burden: These individuals must carry additional medical documentation explaining their condition, adding another layer of complexity to daily activities. Regular re-verification processes and special permissions become a time-consuming necessity.

3.5 Alternative Authentication Needs:

There is a pressing need for flexible authentication alternatives that consider the diverse needs of PWDs post-transplant. Multi-modal biometric systems that allow users to choose from different authentication methods based on their abilities and medical conditions could provide more inclusive solutions.

3.6 Policy and Standards Requirements:

Development of specific standards and policies for biometric systems that address the needs of PWDs post-transplant is crucial. These should include requirements for automatic deactivation of a deceased Aadhar, alternative authentication methods, and regular updates to biometric templates to account for physical changes due to medical procedures. The legal ambiguity becomes particularly problematic when considering identity documentation and access to essential services that increasingly rely on biometric verification.[5]

4. Social And Ethical Implications of Biometric Inclusion:

Post-mortem data management policies present another layer of complexity, especially concerning donated organs and their associated biometric data. The intersection of donor privacy rights and recipient identification needs creates unique challenges. The management of biometric data becomes particularly complex when considering that donated tissues may carry biometric markers of the deceased donor, raising questions about data ownership and

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[5] Sun, Y.; Leng, L.; Jin, Z.; Kim, B.-G. (2022) *Reinforced Palmprint Reconstruction Attacks in Biometric Systems*. Sensors, 22, 591.

privacy rights post-transplantation.[6]

5. Existing Policy and Legal Frameworks:

Previous studies on biometric challenges in medical contexts have predominantly focused on general accessibility issues rather than the specific needs of post-transplant individuals. Research indicates that conventional biometric systems have significantly higher failure rates when attempting to authenticate individuals who have undergone major reconstructive procedures. This highlights a critical gap in both technology development and implementation strategies.[7]

6. Technological Adaptations to Address Biometric Challenges:

Global practices and policies regarding biometric authentication for people with transplants and reconstructions vary considerably. Some countries have implemented alternative authentication methods or override protocols for individuals whose biometric markers have changed due to medical procedures. However, these solutions often lack standardisation and may not be universally accepted, particularly in international contexts.

7. Global Practices and Innovations in Biometric Inclusion:

The systemic barriers created by these challenges extend beyond mere inconvenience, affecting social inclusion and access to essential services. Banking services, government identification, travel documentation, and even workplace access systems frequently rely on biometric authentication, potentially marginalising individuals who cannot consistently provide the required biometric data.

8. Need For Social and Systemic Inclusion

This comprehensive review of the challenges reveals a clear need for more inclusive biometric authentication systems that can accommodate medical changes while maintaining security. The development of adaptive biometric systems, combined with appropriate legal frameworks and standardised protocols for managing changing biometric markers, is essential for ensuring equal access and social inclusion for individuals with transplants and reconstructions. Future

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[6] Bhandari, Vrinda and Sane, Renuka (2019) "*A Critique of Aadhaar Framework,*" National Law School of India Review: Vol. 31: Iss. 1, Article 4.

[7] Sohn JW, Kim H, Park SB, Lee S, Monroe JI, Malone TB, Kinsella T, Yao M, Kunos C, Lo SS, Shenk R and Machtay M (2020) *Clinical Study of Using Biometrics to Identify Patient and Procedure.* Front. Oncol. 10:586232. doi: 10.3389/fonc.2020.586232.

developments in this field must prioritise both security and accessibility, recognizing that biometric markers are not immutable for all individuals.

METHODOLOGY

This doctrinal research adopts a qualitative approach, focusing on the systematic analysis of legal texts, statutes, judicial precedents, and academic commentaries. Primary sources, such as legislative frameworks and case laws, will be critically examined to understand existing legal provisions and their interpretations. Secondary sources, including legal journals, books, and reports, will provide contextual insights and highlight gaps or inconsistencies. The methodology aims to identify ambiguities in the current legal framework, particularly in post-transplant biometric identity management. By analyzing these materials, the study will propose informed recommendations for enhancing legal clarity, policy development, and ethical compliance in this domain.

LIMITATIONS

This doctrinal research is limited by its reliance on existing legal texts and judicial interpretations, which may not fully address emerging issues. It excludes empirical data, reducing practical insights into real-world applications. Additionally, the methodology may overlook interdisciplinary perspectives, restricting the analysis to a purely legal framework without broader societal context.

FINDINGS & SUGGESTION

1.   Current biometric authentication systems, including India's Aadhaar, operate under the assumption of stable biometric markers, but this creates significant challenges for transplant recipients whose physical characteristics have changed. The system particularly struggles when transplanted tissues retain the biometric patterns of deceased donors.

2.   There is a critical legislative gap regarding the deactivation of deceased donors' Aadhaar numbers. The current system places the responsibility on donors' families rather than implementing an automated process through UIDAI and the Registrar General of India upon death certificate issuance.

3.   Post-transplant individuals face widespread systemic barriers in daily activities, from banking and travel to government services and employment, due to biometric authentication failures. These challenges are compounded when their new biometric markers match those of their donors or fail to match their original records.

CONCLUSION

The intersection of organ transplantation and biometric authentication systems reveals significant technological, legal, and ethical challenges that require urgent policy attention. The current framework, exemplified by India's Aadhaar system, operates on an outdated assumption of biometric permanence that fails to account for the complex realities of transplant recipients. This oversight creates a cascade of practical difficulties that transform routine activities into bureaucratic obstacles for transplant recipients. The absence of clear protocols for managing deceased donors' biometric information, coupled with the manual deactivation process of their Aadhaar numbers, creates administrative vulnerabilities that could lead to identity complications. The systemic barriers faced by transplant recipients in accessing essential services highlight a critical gap between medical advances and identity infrastructure. This misalignment particularly affects recipients whose new biometric markers either match their donors' or fail to align with their original records, effectively turning their life-saving treatment into a source of persistent administrative challenges. The current legislative framework's inability to address these unique circumstances calls for a comprehensive policy overhaul. While existing provisions for Persons with Disabilities offer some flexibility, they fail to specifically address the unique challenges faced by transplant recipients. A more nuanced approach is needed that balances security requirements with accessibility, perhaps through the development of alternative authentication methods for individuals with transplant-modified biometrics. Moving forward, policymakers must prioritize the development of adaptive authentication systems that can accommodate medical interventions while maintaining security and privacy. This could include implementing automated processes for managing deceased donors' biometric data, establishing clear protocols for updating recipient authentication records post-transplant, and creating specific provisions for individuals whose biometric markers have been altered through medical procedures.