




# Chemotherapy-Induced Fingerprint Effacement Leading to Deprivation of Health Insurance: A Case Series and Review of Literature

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Ind J Med Paediatr Oncol 2025;46:114–118.

## Abstract

### Keywords

- PMJAY
- fingerprints
- cancer
- chemotherapy
- Ayushman Bharat

Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PMJAY) is a game changer for the Indian health care system, where patients with cancer are the major beneficiaries. Some intrinsic procedural shortcomings are restricting the beneficiaries to utilize it optimally. We report a case series of patients receiving chemotherapy who had developed adermatoglyphia because of chemotherapeutic treatment. Therefore, these patients became ineligible for getting the benefits of PMJAY, because of failure of the biometric system to recognize their fingerprints. Hence, patient treatment could not be completed. As a solution, we suggest that the alternatives to fingerprint recognition like face recognition and iris scanning be incorporated into the biometric system to ensure continuous benefit of PMJAY to such patients.

## Introduction

Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PMJAY) was launched by the Indian government to ensure health care services worth Rs. 500,000 per family per year for the poor and vulnerable population (~50 million).<sup>1</sup> According to GLOBOCAN-2020 estimates, nearly 1.3 million new cases of cancer were diagnosed in India during the year 2020.<sup>2</sup> Among all the specialties covered by PMJAY, patients with cancer receive the greatest benefit. Nearly 700,000 chemotherapy procedures have been performed under this scheme since 2018.<sup>3</sup> Access and adherence to cancer care services have improved with this program, and will eventually lead to a reduction in cancer-related deaths in India. Before every chemotherapy procedure, patients go through a verification process of fingerprint recognition and Aadhaar card verification to be eligible for PMJAY

benefits. Unfortunately, adermatoglyphia is anticipated to occur in nearly 40% of certain subsets of patients with cancer, causing them to lose their fingerprints after the start of chemotherapy.<sup>4</sup>

We describe a series of patients who received chemotherapy under the PMJAY for different malignancies and developed adermatoglyphia because of chemotherapy. Premature loss of the fingerprint caused the failure of the verification system to authenticate their procedures. Hence, they could not get the benefit of chemotherapy treatment under the PMJAY scheme, leading to disease progression. We noticed that this condition also affects their ability to use their digital gadgets such as smart phones that commonly require fingerprint verification to lock or unlock them. This can cause additional distress as it affects their independence and daily routines.

article published online  
November 25, 2024

DOI <https://doi.org/10.1055/s-0044-1795094>.  
ISSN 0971-5851.

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Thus, Adermatoglyphia may not only deprive patients of health insurance benefits but also hinder their use of everyday technology. In this case series, following ethical committee waiver and patient consent, we describe the cases of four patients who were unable to receive chemotherapy under the PMJAY scheme. This was because, due to their adermatoglyphia, the fingerprint scanner was unable to authenticate their identity before a chemotherapy procedure- a routine process before admission under PMJAY- which leads to disease progression in the absence of treatment.

## Case Report

### Case 01

A 19-year-old man presented with a large mass in the left cervical region and the left lung apex that involved the extra-parenchymal lung tissue with an erosion of the C7, D1, and D2 vertebrae and the scapula. He was diagnosed with Ewing's sarcoma in August 2022. He was started on the VAC (vincristine, doxorubicin, and cyclophosphamide) drug regimen. He completed four cycles of chemotherapy and was responding well. However, his PMJAY card registration eventually failed,

because the biometric system could not recognize his fingerprints (►Fig. 1a). On examination, his fingerprints were not elicitable due to chemotherapy, with other potential causes being ruled out. Therefore, he could not be admitted for further treatment. However, his treatment was eventually resumed after a delay of 1 month. With crowdfunding and nongovernmental organization (NGO) support, he was able to complete 13 palliative chemotherapy cycles of VAC without PMJAY support.

### Case 02

A 27-year-old man presented with complaints of abdominal pain and obstruction in November 2022. On evaluation, he was diagnosed with adenocarcinoma of the right colon and underwent laparotomy with right hemicolectomy. The post-op histopathology was suggestive of adenocarcinoma of the right colon (pT3N1M0). He was planned for adjuvant chemotherapy (FOLFOX regimen). Nevertheless, after completion of five cycles, his PMJAY card registration failed because his fingerprints were not recognized by the biometric system (►Fig. 1b). The remaining cycles were completed with NGO support.



**Fig. 1** Image displaying the loss of fingerprints (adermatoglyphia) after chemotherapy in (a) case 01, (b) case 02, (c) case 03, and (d) case 04.

**Case 03**

A 49-year-old woman presented with complaints of bleeding per rectum, diarrhea, and vomiting in December 2022. The diagnostic workup was conclusive of metastatic adenocarcinoma of the rectum (with nonregional lymph nodes). She was planned to undergo palliative chemotherapy and was started on mFOLFOX-4 regimen (modified 5-fluorouracil, oxaliplatin, and leucovorin). She completed six cycles of scheduled chemotherapy. Following this, her PMJAY card was rendered nonfunctional because of her inability to perform biometric registration (►Fig. 1c). After 3 months, her disease progressed.

**Case 04**

A 55-year-old postmenopausal woman was diagnosed with invasive ductal carcinoma of the right breast (cT3N1M0 and ER/PR/Her2negative). She was started on neoadjuvant chemotherapy with four cycles of epirubicin and cyclophosphamide (AC), followed by four cycles of paclitaxel. She underwent modified radical mastectomy. The post-op histopathology was suggestive of residual disease (ypT2N0M0). She received adjuvant radiotherapy and was kept on capecitabine. After completing 3 months of capecitabine, her PMJAY card registration failed because of nonrecognizable fingerprints (►Fig. 1d). The recommended duration of her treatment was 6 months to 1 year; nonetheless, she could receive treatment for only 3 months, which increase the risk of recurrence in her case.

**Discussion**

In the preceding month, 300 chemotherapy procedures (including new cases and follow-up cases) were performed. Of these, 70 were newly diagnosed patients, and 30 of the newly diagnosed patients received 5-FU/Capecitabine based therapy. In this study, the cases of four patients have been presented, detailing their complaints and histories to demonstrate how an uncommon side effect of chemotherapy rendered them ineligible for receiving insurance benefits. To avail of the PMJAY scheme, patients must register using a biometric registration system, which uses fingerprints for identification. However, dermatoglyphia, caused by capecitabine, 5-fluorouracil, and cyclophosphamide, led to treatment interruption as it precluded fingerprint verification. These conditions have been reported in the past. Al-Ahwal reported a case from Saudi Arabia that is comparable to this one, where the patient had endured administrative delays due to the loss of their fingerprints.<sup>5</sup> Azadeh et al also reported cases of patients with cancer undergoing chemotherapy who experienced similar administrative delays in Tehran.<sup>6</sup> Children who are younger than 5 years suffering from curable cancers also become ineligible for the PMJAY scheme due to incompletely developed fingerprints. A report by van Doorn et al involving of 112 patients showed that 70 and 46% patients receiving capecitabine or TKI (tyrosine kinase inhibitors) developed hand-foot syndrome (HFS) or hand-foot skin reaction (HFSR), respectively, but only 14 and 2% treated with capecitabine or TKI had a severe quality loss of fingerprints.<sup>7</sup> The mechanism of HFS causing loss of

**Table 1** Various techniques used for biometrics verification

Sl. no.	Technique
1	Face recognition
2	Iris recognition
3	Hand geometry
4	Voice recognition
5	Keystroke dynamics
6	Gait
7	Radiofrequency identification technology

fingerprints is not well established, but the above reports show that loss of fingerprints may not be seen in all patients receiving capecitabine or TKI irrespective of the grade of HFS and should be considered as a secondary reaction independent of HFS or HFSR.<sup>8</sup>

Available modalities for biometric evaluation include fingerprint recognition, which is the most commonly utilized method. Other recognition techniques<sup>9,10</sup> are listed in ►Table 1. One of the aforementioned alternatives in addition to fingerprint verification has been recommended to be added to the PMJAY software. These alternatives will ensure that those in need continue to benefit from the program. The PMJAY scheme is a game changer in the Indian health care system and a substantial proportion of the Indian population has benefited from this scheme. Patients face multiple problems to obtain this card. After this, if they stop getting benefits of this scheme because of chemotherapy-related toxicities or complications, it understandably becomes bothersome for patients and their families. The deprivation from treatment not only increases their chance of disease recurrence but also increases the demand for palliative and end-of-lifecare services, which are sparsely available in India.<sup>11</sup>

The strength of using a fingerprint scanner is that it is a liable and cheap source of unique identification and is easy to use, whereas other modalities are costly and require training of the staff for appropriate use. Looking at the growing Indian population, implementation of such technologies seems challenging and may add to health care costs. Nevertheless, successful implementation of DigiYatra in airports for quick verification using face recognition of passengers exemplifies a suitable future alternative in health care. Thus, patients in need will never be deprived of the benefits from the PMJAY scheme.

**Conclusion**

The PMJAY scheme is addressing a relevant need in the Indian health care system. However, some intrinsic procedural issues tend to exclude some patients from getting its benefit. The aforementioned problem statement is a real-world problem. Furthermore, facial recognition and iris scanner seem to be suitable alternatives to fingerprint verification. Adding these identification alternatives for the PMJAY scheme will ensure continuation of benefit from the program.

**Authors' Contributions**

The manuscript has been read and approved by all the authors, and each author believes that the manuscript represents honest work.

**Patient Consent**

Patient consent was taken before the preparation of the manuscript.

**Funding**

None.

**Conflict of Interest**

None declared.

**Acknowledgments**

The authors would also like to thank Mr. Mahesh Sharma, in charge of PMJAY at Sri Aurobindo Institute of Medical Sciences, Indore, Madhya Pradesh, for helping us with details of the PMJAY identification systems required for diagnosis of this unique problem. The authors would also like to thank the TYAcan Foundation for providing financial support to this patient.

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