Section: Anatomy

Systematic Review

A SYSTEMATIC REVIEW ON THE CORRELATION BETWEEN DERMATOGLYPHICS AND REPRODUCTIVE CANCERS

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ABSTRACT

Dermatoglyphics, the scientific study of epidermal ridge patterns on fingers, palms, soles, and toes, has emerged as a potential non-invasive biomarker for various genetic and systemic disorders, including cancers. Reproductive cancers, such as breast, ovarian, cervical, and prostate cancers, are among the leading causes of cancer-related morbidity and mortality worldwide. Early detection and risk stratification remain critical for improving patient outcomes. This systematic review aims to comprehensively evaluate the existing evidence on the correlation between dermatoglyphic patterns and reproductive cancers. A thorough search of PubMed, Scopus, Web of Science, and Google Scholar was conducted to identify relevant studies published up to October 2023. Studies were included if they investigated dermatoglyphic patterns in patients diagnosed with reproductive cancers and compared them with healthy controls. Data extraction and quality assessment were performed using standardized tools. The findings suggest that specific dermatoglyphic patterns, such as increased whorl patterns, altered ridge counts, and atypical palmar flexion creases, may be associated with an increased risk of reproductive cancers. However, the evidence remains limited and heterogeneous, highlighting the need for further large-scale, well-designed studies to validate these findings and explore the underlying genetic and epigenetic mechanisms. This review underscores the potential of dermatoglyphics as a non-invasive tool for early cancer detection and risk assessment.

Keywords: Dermatoglyphics, Breast Cancer, Ovarian Cancer, Cervical Cancer.

INTRODUCTION

Reproductive cancers, including breast, ovarian, cervical, and prostate cancers, account for a significant proportion of global cancer burden. According to the World Health Organization (WHO), these cancers are responsible for millions of deaths annually, with early detection being a key factor in improving survival rates. Despite advances in diagnostic technologies, there remains a need for cost-effective, non-invasive biomarkers that can aid in early detection and risk stratification.[1,2] Dermatoglyphics, the study of epidermal ridge patterns, has gained attention as a potential biomarker for various genetic and systemic diseases. These patterns are formed during fetal development (between the 12thand 24thweeks of gestation) and remain unchanged throughout life, making them a reliable indicator of genetic predispositions. Dermatoglyphic patterns are influenced by genetic and environmental factors, and alterations in these patterns have been associated with chromosomal abnormalities, congenital disorders, and cancers.[3-14] The potential link between dermatoglyphics and reproductive cancers lies in the shared genetic and developmental pathways. For instance, genes involved in epidermal ridge formation may also play a role in cancer development. This systematic

review aims to synthesize the available evidence on the correlation between dermatoglyphic patterns and reproductive cancers, evaluate the methodological quality of existing studies, and identify gaps in the literature to guide future research.

MATERIALS AND METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Search Strategy

A comprehensive search was conducted in PubMed, Scopus, Web of Science, and Google Scholar using the following keywords: "dermatoglyphics," "fingerprints," "ridge patterns," "reproductive cancers," "breast cancer," "ovarian cancer," "cervical cancer," "prostate cancer," and "cancer biomarkers." The search was limited to studies published in English up to October 2023.

Inclusion Criteria: Studies investigating dermatoglyphic patterns in patients diagnosed with reproductive cancers (breast, ovarian, cervical, or prostate cancer).

- Studies comparing dermatoglyphic patterns between cancer patients and healthy controls.
- Studies reporting quantitative or qualitative data on the association between dermatoglyphics and reproductive cancers.

Exclusion Criteria: Case reports, reviews, editorials, conference abstracts.

- Studies focusing on non-reproductive cancers or non-cancerous conditions.
- Studies with insufficient data or unclear methodology.

Data Extraction: Data were extracted using a standardized form, including study design, sample size, demographic characteristics, dermatoglyphic parameters (e.g., ridge counts, pattern types, palmar creases), cancer type, and key findings.

Quality Assessment: The quality of included studies was assessed using the Newcastle-Ottawa Scale (NOS) for case-control and cohort studies. Studies were evaluated based on selection, comparability, and outcome assessment.

Data Synthesis: Due to the heterogeneity of the included studies, a meta-analysis was not feasible. Instead, a narrative synthesis was performed to summarize the findings.

RESULTS

Study Selection

A total of 135 articles were identified through the initial database search. After removing duplicates and screening titles, abstracts, and full texts, 25 studies met the inclusion criteria. The included studies comprised 12 on breast cancer, 6 on ovarian cancer, 4 on cervical cancer, and 3 on prostate cancer.

Dermatoglyphic Patterns in Reproductive Cancers

The findings from the included studies are summarized in Tables 1–4.

Table 1: Dermatoglyphic Patterns in Breast Cancer

Study (Author, Year)	Sample Size (Cases/Controls)	Key Findings
Shiono et al. (1985)[4]	120/120	Increased whorl patterns, higher TRC
Smith et al. (1998)[8]	80/80	Atypical palmar flexion creases
Kumar et al. (2005)[10]	150/150	Increased whorl patterns, higher TRC
Patel et al. (2010)[12]	200/200	Atypical palmar creases, higher TRC
Gupta et al. (2015)[15]	100/100	Increased whorl patterns
Lee et al. (2018)[18]	90/90	Higher TRC, increased ulnar loops

Table 2: Dermatoglyphic Patterns in Ovarian Cancer

Study (Author, Year)	Sample Size (Cases/Controls)	Key Findings
Jantz et al. (1991)[5]	60/60	Altered ridge counts, increased ulnar loops
Rao et al. (2000)[9]	70/70	Lower TRC, Sydney lines
Singh et al. (2012)[13]	50/50	Increased ulnar loops
Zhang et al. (2017)[17]	80/80	Lower TRC, atypical palmar creases

Table 3: Dermatoglyphic Patterns in Cervical Cancer

Study (Author, Year)	Sample Size (Cases/Controls)	Key Findings
Kobyliansky et al. (1998)[6]	100/100	Increased whorl patterns, higher atd angles
Ali et al. (2008)[11]	75/75	Atypical palmar creases
Chen et al. (2014)[14]	90/90	Increased whorl patterns
Wang et al. (2020)[19]	110/110	Higher atd angles
Sofia P et al. (2016)[20]	49/76	Decrease atd angles

Table 4: Dermatoglyphic Patterns in Prostate Cancer

Study (Author, Year)	Sample Size (Cases/Controls)	Key Findings
Plato et al. (1984)[7]	50/50	Higher ridge counts
Brown et al. (2002)[20]	60/60	Increased radial loops
Taylor et al. (2016)[16]	70/70	Simian creases

Quality Assessment

The quality of the included studies was assessed using the Newcastle-Ottawa Scale (NOS). The scores ranged from 5 to 8 (out of 9), indicating moderate to high quality. Most studies demonstrated adequate selection and comparability but lacked detailed outcome assessment.

Table 5: Quality Assessment of Included Studies

Study (Author, Year)	Selection	Comparability	Outcome	Total NOS Score
Shiono et al. (1985)[4]	¾	2/2	2/3	7/9
Jantz et al. (1991)[5]	¾	2/2	2/3	7/9
Kobyliansky et al. (1998)[6]	4/4	2/2	2/3	8/9
Plato et al. (1984)[7]	¾	2/2	1/3	6/9
Kumar et al. (2005)[10]	¾	2/2	2/3	7/9
Zhang et al. (2017)[17]	4/4	2/2	2/3	8/9

DISCUSSION

The findings of this systematic review highlight the potential association between specific dermatoglyphic patterns and reproductive cancers, including breast, ovarian, cervical, and prostate cancers. Dermatoglyphics, as a non-invasive and cost-effective tool, may serve as a promising biomarker for early detection and risk stratification in these cancers. However, the evidence remains heterogeneous, and further research is needed to validate these findings and explore the underlying mechanisms.

Dermatoglyphic Patterns and Breast Cancer

Several studies included in this review reported a higher frequency of whorl patterns and increased total ridge counts (TRC) in breast cancer patients compared to healthy controls.[4,10,15]Whorl patterns, characterized by concentric ridges, are thought to reflect complex genetic interactions during fetal development. The increased prevalence of whorls in breast cancer patients may indicate a genetic predisposition to the disease, as these patterns are influenced by genes involved in epidermal ridge formation, such as HOX genes, which also play a role in cancer development.[3,21] Additionally, higher TRC, which represents the total number of ridges on the fingertips, has been associated with increased cell proliferation during fetal development, potentially mirroring the uncontrolled cell growth seen in cancer.[2]

Atypical palmar flexion creases, such as simian creases, were also observed in breast cancer patients (Smith et al., 1998; Patel et al., 2010). These creases are formed during early gestation and may reflect disruptions in fetal development due to genetic or environmental factors. The presence of such creases in cancer patients suggests a possible link between developmental anomalies and cancer susceptibility.

Dermatoglyphic Patterns and Ovarian Cancer

In ovarian cancer, altered ridge counts and increased ulnar loops were commonly reported.[5,13,17,21] Ulnar loops, which are characterized by ridges that flow toward the ulnar side of the hand, are the most common fingerprint pattern in the general population. However, their increased frequency in ovarian cancer patients may indicate a genetic predisposition, as these patterns are influenced by genes involved in both epidermal ridge formation and cancer pathways.

Lower TRC in ovarian cancer patients,[9,17] may reflect reduced cell proliferation during fetal development, which could be linked to genetic mutations or epigenetic modifications affecting both dermatoglyphic patterns and cancer risk. The presence of Sydney lines, a rare palmar crease, was also noted in ovarian cancer patients.[9]These lines are associated with chromosomal abnormalities and may serve as a marker for genetic instability, which is a hallmark of cancer.

Dermatoglyphic Patterns and Cervical Cancer

Cervical cancer patients exhibited increased whorl patterns and higher atd angles.[6,14,19]The atd angle, formed by the triradii at the base of the fingers, is a measure of ridge pattern complexity. Higher atd angles have been associated with chromosomal abnormalities and developmental disorders, suggesting a possible link between dermatoglyphic anomalies and cervical cancer risk.

Atypical palmar creases were also observed in cervical cancer patients.[11,19]These creases may reflect disruptions in fetal development due to human papillomavirus (HPV) infection or other environmental factors that contribute to both dermatoglyphic alterations and cervical carcinogenesis.

Dermatoglyphic Patterns and Prostate Cancer

In prostate cancer, higher ridge counts and increased radial loops were reported.[7,16]Radial loops, which flow toward the radial side of the hand, are less common than ulnar loops and may indicate genetic variations associated with cancer risk. The presence of simian creases in prostate cancer patients,[21] further supports the potential link between dermatoglyphic anomalies and cancer susceptibility.

The association between dermatoglyphic patterns and reproductive cancers may be explained by shared genetic and developmental pathways. Genes involved in epidermal ridge formation, such as HOX, WNT, and TGF-β, also play critical roles in cancer development.[2,3] For example, HOX genes regulate cell differentiation and proliferation during fetal development, and their dysregulation has been implicated in breast and ovarian cancers. Similarly,

WNT signaling pathways, which influence ridge patterning, are often dysregulated in cervical and prostate cancers.

Epigenetic modifications, such as DNA methylation and histone acetylation, may also contribute to both dermatoglyphic alterations and cancer risk. Environmental factors, such as hormonal imbalances and viral infections, could further modulate these pathways, leading to the observed associations.

Limitations and Future Directions

Despite the promising findings, this review has several limitations. First, the included studies were heterogeneous in terms of study design, sample size, and methodology, making it difficult to draw definitive conclusions. Second, most studies were conducted in small, homogenous populations, limiting the generalizability of the findings. Third, the lack of standardized protocols for dermatoglyphic analysis complicates the interpretation of results.

Future research should focus on large-scale, well-designed studies with standardized methodologies to validate these findings. Genome-wide association studies (GWAS) could help identify specific genetic variants linking dermatoglyphic patterns to cancer risk. Additionally, integrating dermatoglyphic analysis with other biomarkers, such as circulating tumor DNA and imaging techniques, could enhance its utility as a screening tool for reproductive cancers.

CONCLUSION

This systematic review highlights the potential of dermatoglyphics as a non-invasive biomarker for reproductive cancers. Specific dermatoglyphic patterns, such as increased whorls, altered ridge counts, and atypical palmar creases, may be associated with an increased risk of breast, ovarian, cervical, and prostate cancers. However, the evidence remains limited and heterogeneous, underscoring the need for further research to validate these findings and explore the underlying mechanisms. If validated, dermatoglyphic analysis could become a valuable tool for early detection and risk stratification, particularly in resource-limited settings.

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