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Mansor, S.F.[a] [b] , Syafiq, T.M.F.[c] , Yahaya, B.H.[b]

Three-dimensional culture model of urothelial carcinoma cell lines: current advances, challenges and future perspective

[a] Faculty of Health Sciences, Universiti Teknologi MARA, Cawangan Pulau Pinang, Kampus Bertam, Pulau Pinang13200, Malaysia
[b] Department of Biomedical Sciences, Advanced Medical and Dental Institute (AMDI), Universiti Sains Malaysia, Penang, Kepala Batas, 13200, Malaysia
[c] Institute of Planetary Health for Sustainable Well-being, International Islamic University Malaysia, Pahang, Kuantan, 25100, Malaysia

Abstract
Despite the high number of cases reported, studies describing the pathogenesis of urothelial carcinoma (UC) remain limited. This is due to insufficient in vivo models that can accurately recapitulate the pathogenesis of UC recurrence and elucidate the involvement of the tumour microenvironment (TME) during carcinogenesis. Models of cancer pathomechanism in monolayer culture provide inaccurate resemblance due to biophysical and chemical changes. In simplified 2D culture conditions, factors such as tissue architecture, cell-to-cell and cell-to-matrix interaction, and mechanical and biochemical networks, all of which are involved in drug response, are lost. Three-dimensional (3D) culture of clinical biopsy is considered an ideal model to understand UC pathogenesis, the role of the microenvironment, and mechanical adaptations due to improved translational capacity. However, limited biopsies and challenges in primary cell culturing have shifted researchers towards developing cell line-based 3D culture in the pursuit of pathomechanism exploration. A comprehensive literature evaluation was carried out by searching the PubMed, Scopus, and Web of Science databases from January 2000 to May 2022. The initial search yielded 525 articles, and 195 studies were selected based on the inclusion and exclusion criteria. This review highlights recent challenges, future strategies, and the clinical implications of developing high-throughput, cell line-based 3D models for personalized UC treatment, a critical gap in the current literature. © Biomedpress.

Author Keywords
3D culture; machine learning; microfluidic chip; model development; tumour microenvironment; urothelial carcinoma cell line

Index Keywords
doxorubicinol, fibronectin, growth hormone, mucin 1; brachytherapy, cancer recurrence, carcinogenesis, carcinoma cell line, cell matrix interaction, computer assisted tomography, computer model, human, immunohistochemistry, liver cell, machine learning, metabolomics, microenvironment, molecular docking, pathogenesis, positron emission tomography, Review, systematic review, three dimensional printing, transitional cell carcinoma, tumor microenvironment, umbilical vein endothelial cell

Chemicals/CAS
doxorubicinol, 54193-28-1; fibronectin, 86088-83-7; growth hormone, 36992-73-1, 37267-05-3, 66419-50-9, 9002-72-6; mucin 1, 212255-06-6

Correspondence Address
Yahaya B.H.; Department of Biomedical Sciences, Penang, Malaysia; email: badrul@usm.my