ASSERTION OF A DIDACTIC ILLUSTRATION SCHEME OF THE IMMUNOLOGICAL RELATIONSHIP BETWEEN THE INDUCTION OF THE CCL5/CCR5 AXIS BY HIV-1 INFECTION AND NEUROAIDS

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INTRODUCTION/AIMS

The occurrence of neurological illness in an HIV-positive individual is the result of a series of circumstances, such as the host immune response. HIV interacts with C-C chemokine receptor type 5 (CCR5) or C-X-C chemokine receptor type 4 (CXCR4), which serve as viral co-receptors, after employing CD4+ T cells as the main receptor. CCR5 orientates the functions of chemokines from the C-C class, including C-C Motif Chemokine Ligand 5 (CCL5/RANTES), which participates in defense against HIV-1. Co-receptor signaling may also contribute to ongoing neuroinflammation and indirect neurotoxicity, both of which may aid in the development of neuroAIDS (Shah et al., 2011). This research sought to review and build a didactic model about the immunopathological relationship between the CCL5/CCR5 axis and neuroAIDS progression.

METHODS

This is a systematic review, according to PRISMA 2020, using articles and reviews published between January 1990 and June 2023 in PUBMED, LILACS, MEDLINE, and SCIELO databases through the descriptors: "HIV-1"; "CCR5"; "CCL5" and "Neurological Manifestations". The methodological quality assessment was done through JBI Checklists. From this, the schematic construction was made on paper with office supplies, and, therefore, its digitization and painting in Adobe Photoshop CS6 program.

RESULTS AND DISCUSSION

The search resulted in 36 articles. CCR5 is the primary receptor for HIV-1 entry in cells when combined with the viral glycoprotein 120 (gp120). Additionally, through gp120-mediated rises in CCL5/RANTES mRNA, RANTES/CCL5 can oligomerize on the cell surface and act as a powerful modulator of inflammation, particularly, neuroinflammation, and a contributor to neuroAIDS (Liu et al., 2014). Figure 1 explains the progression of neuroAIDS by the view of CCL5/CCR5 immune axis induction.

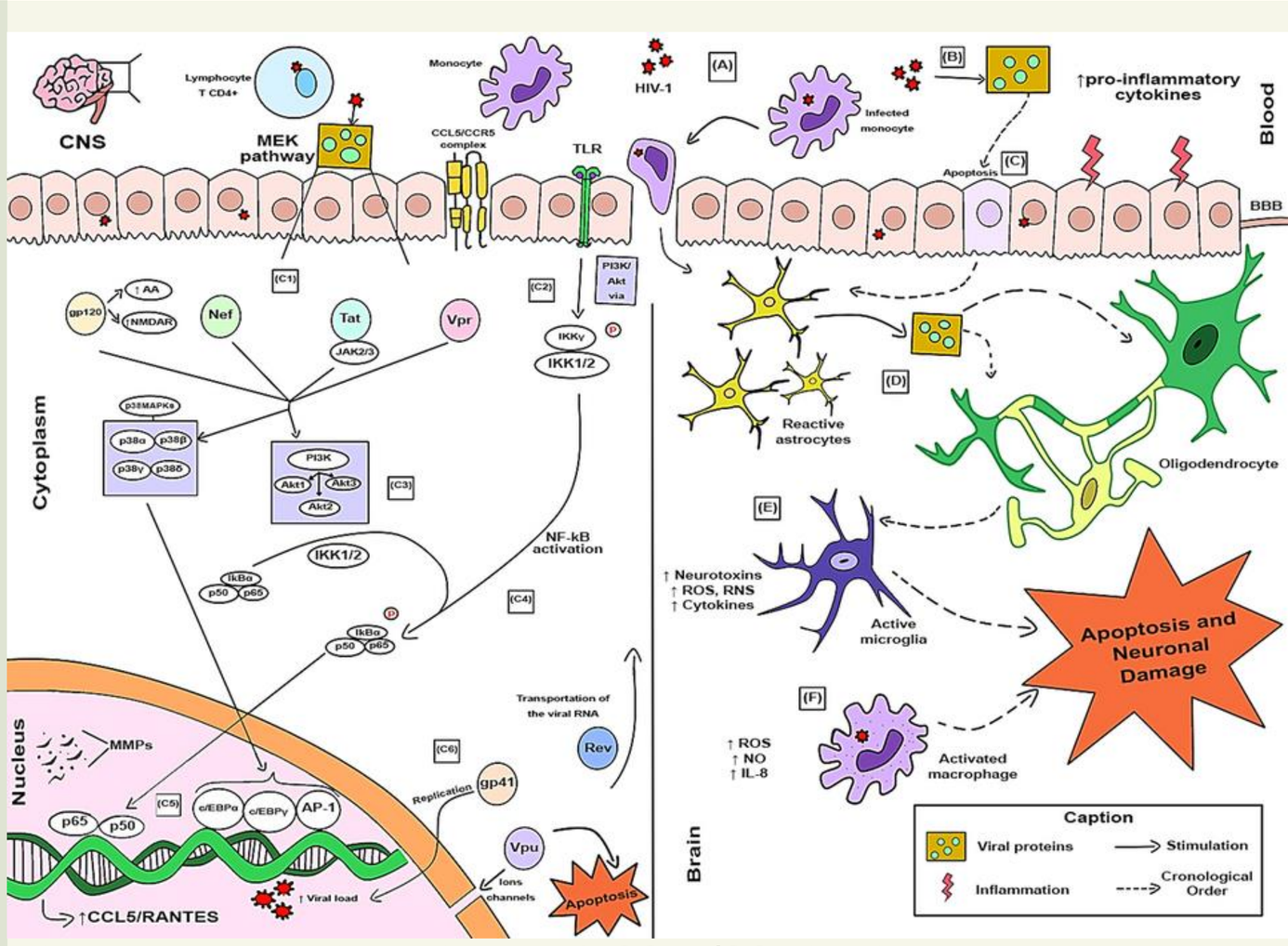

Figure 1. Illustrative scheme of CCL5/CCR5 axis induction by HIV-1 infection and HIV-1 neurotoxicity effects in molecular and cellular levels of the central nervous system (CNS). They are indicated in chronological order of events by letters (A-Z).

It describes the stages of immune processes in the human body from viral entry into the CNS cells and the processes of adhesion and recognition by APCs (A), viral replication process releases viral proteins that exacerbate the inflammatory process (B), the activation of cell signaling pathways (C): in the cellular cytoplasm, viral proteins act on joint pathways for secretion of co-stimulatory molecules of this inflammation (C1); Toll-like Receptors (TLRs) activate other protein pathways that induce phosphorylation of molecules related to the activation of the KF-kB pathway (C2-C4); with subsequent increased release of CCL5/RANTES and matrix metalloproteinases (MMPs) associated with neuroinflammation (C5); other viral proteins act by increasing the viral load and generating an inflammatory cycle (C6). Ultimately, they generate reactive astrocytes, affected oligodendrocytes and neurons, and ROS, RNS, inflammatory mediators and neurotoxins determine apoptosis and damage to neuronal cells (D-F).

CONCLUSIONS

Therefore, when high concentrations of CCL5/RANTES are present in the body of HIV-1 infected ones, there is production of more intense inflammatory responses in certain regions of the body, culminating, for example, in the onset of dementia in these patients.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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