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RESEARCH ARTICLE

The Role of Growth-Associated Protein-43 (GAP-43) and Superior Cervical Ganglion-10 (SCG-10) mRNA and Protein Levels in Dorsal Root Ganglion Neurons of Lumbar Spinal Cord Segments (L4-L5) Associated with Sciatic Injured Nerve

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Abstract

The analysis focuses on the role of growth-associated protein-43 (GAP-43) and superior cervical ganglion-10 (SCG-10) mRNA and protein levels not only in DRG neurons of lumbar spinal cord segments (L4-L5) associated with sciatic injured nerve. The objective of the research study is to unearth the role of growth-associated protein-43 (GAP-43) and superior cervical ganglion-10 (SCG-10) mRNA and protein level not only in DRG neurons of lumbar spinal cord segments (L4-L5) associated with sciatic injured nerve. The sources were past scientific papers that were published and obtained from google scholar and other sites with open source access. The research review is an original work. The analysis will be centered on a review article that focused on analysis on advantages and disadvantages GAP 43 as neuroregeneration marker examination in rat sciatic nerve injury. The study eligibility criteria was articles that are not older than fifteen years, are written in English and are published.

Key words: *Sciatic nerve injury, GAP-43, SCG-10 and DRG neurons of L4-L5.*

Introduction

GAP 43 is the short name for growth associated protein 43. It is a gene which has encoded protein which is associated with high levels of neurological growth cones in the development of axonal regeneration. Because of its high levels of neurological growth, it is also termed as plasticity or growth protein.

In the nervous system, this protein is considered critical in regenerative response. GAP 43 plays a crucial role in elongation of the axon. Research shows that a decline in GAP 43 is related to the termination of developmental axon, a subpopulation of Dorsal root nerves neurons retains their constituent expression throughout adulthood.

Dorsal root nerves (DRG) carry sensory neurons from the peripheral nervous system to the central nervous system. They emerge from the spinal nerves' carrying sensory messages from various receptors, inclusive of those for temperature and pain to the central nervous system. This piece reviews how GAP 43 influences growth in schiatic injured nerves. It also assesses how the different protein levels and superior cervical ganglion influences growth of schiatic injured nerves.

Rationale

Successful axon regeneration results after activation of regenerative programs. Activation of the neuronal pro-regenerative state is characterized by upregulation of various transforming factors, regeneration-associated genes and proteins. These factors are fundamental intrinsic elements of neuronal regeneration capacity.

Objective

The objective of the research study is to unearth the role of growth-associated protein-43 (GAP-43) and superior cervical ganglion-10 (SCG-10) mRNA and protein level not only in DRG neurons of lumbar spinal cord segments (L4-L5) associated with sciatic injured nerve. The intervention available will be the scientific research materials on GAP-43, SCG-10 mRNA and protein levels available at Journal of Global Pharma Technology.

The comparison will comprise various claims made by several identified publications. The predictable outcome is that GAP-43; SCG-10, mRNA and protein levels are upregulated and play significant roles in dorsal root ganglion of other spinal cord segment associated with sciatic nerve injury. Case study design will be used to analyze the various publications revolving around the research topic.

Material and Methods

Major related publications will be sort from Google scholar: https://scholar.google.com/ and the others from the general google search engine. Distinct focus is placed on the analysis of a review article published on 2019. The research was centered on the analysis on advantages and disadvantages GAP-43 as a neuroregeneration marker examination in rat sciatic nerve injury.

Eligibility Criteria

Articles that are not older than fifteen years, are written in English and are published will meet the eligibility criteria. The rationale of this is to minimize the use of out dated data, minimize language barrier and ensure that the data obtained from the respective articles are credible.

Search Strategy

Key words used will be sciatic nerve injury, GAP-43, SCG-10 and DRG neurons of L4-L5.

Discussion

Neuronal injury can be defined as physiological stimulation of mechanisms of repair or healing by the body after neuronal injury [1]. Recent studies showed that PI3K is highly efficient in the regulating of the whole process of neuronal regeneration. Thus it is correct to assert PI3K plays a vital role in signaling a pathway that leads to a response injury of the peripheral neuronal regeneration [2]. Margiana et al [1].Collects data that shows the key role GAP-43 plays in development of a mammal's size and the development of its central system.

It depicted how it is crucial for the preservation of both the structure and the dynamics of the axonal fibers. GAP-43 is also crucial in correcting a rat's synaptic terminal even in the cases where axonal sprouting is triggered by lesion.

In Komori's [3] research, the findings show that nerve litigation regulates up to 67 proteins. Assault to primary sensory neurons triggered various cellular mechanisms significant for the structural and functional integrity of neurons and protective against oxidative injury. Their data indicated that the regulation of metabolic enzymes met the DRG cells alteration requirement. Their data also indicated that in the sensory neurons of embryos, upregulation of L4 DRG proteins was caused by ligation of the L5 spinal nerve.

Mason [4] on the other hand carries out a research on mature rats for axonal regeneration. The author compares SCG10 with GAP-43 and CAP -23 to reach her findings. Her findings indicate that the mRNAs coding for CAP-23, GAP-43 and SCG-10 were greatly upregulated by DRG neurons after ligation of the sciatic nerve. This was before dorsal rhizotomy. There was prolonged manifestation of the 3 mRNAs as soon as the sciatic nerve was crushed to avert reinnervation of targets.

There was no upregulation of any of these mRNAs in dorsal thalamus and cerebellar cortex neurons thus became poorly regenerated. He found out that living peripheral nerve which transmitted signals seemed to retain manifestation of the 3 mRNAs in neurons that were regenerating. In Kawasaki et al. research, the evidence shows more than thirty thousand phosphopeptides of 1,200 proteins. The research is carried out on cone phosphoproteomics.

Their data suggests that in the mammalian brain, phosphorylation of proteins that were highly proline-directed is those that regulated growth of nerves. Further examination showed that microtubules and the cortical cytoskeleton had very high levels of phosphoproteins. S96 site of GAP-43 was the highest phosphorylated site. Before, the undistinguished site that was phosphorylated remained to be JNK dependent. They identified that axons that were undergoing regeneration had S96 phosphorylation as the commonest target of JNK signaling.

This denoted an assuring recent molecular marker for either regenerating or growing axons.

According to Dubový's research, after 7 days of a unilateral sciatic nerve injury by transaction or compression, L4-L5 and C6-C8 spinal cord segments showed a bilateral buildup of protein levels and GAP-43 and SCG-10 mRNA in DRG neurons associated with injured nerve.

The rise in regeneration-linked proteins in the C6-C8 DRG neurons was linked with the increased segment of the regenerated axons a day prior to ulnar nerve ligation following sciatic nerve crush that happened before as contrasted to controls with only ulnar nerve ligation. Neurite outgrowth assay of in vitro cultivated DRG neurons established the augmented ability of the axons to regenerate in the C6-C8 DRG neurons after a previous acclimatizing sciatic nerve lesion. The function of the IL-6 signaling pathway in triggering the pro-regenerative state in remote DRG neurons was depicted by Intrathecal injection of JAK2 inhibitor (AG490) or of IL-6. Therefore, there was a systemic effect of these neurons because of the unilateral sciatic nerve injury. This resulted in the pro-regenerative state in the DRG neurons that were not associated with the ligated nerve. Thus, in determining the regenerative ability of neuronal determinants, SCG10, CAP-23, and GAP-43, are likely to be vital.

PRISMA 2009 Flow Diagram

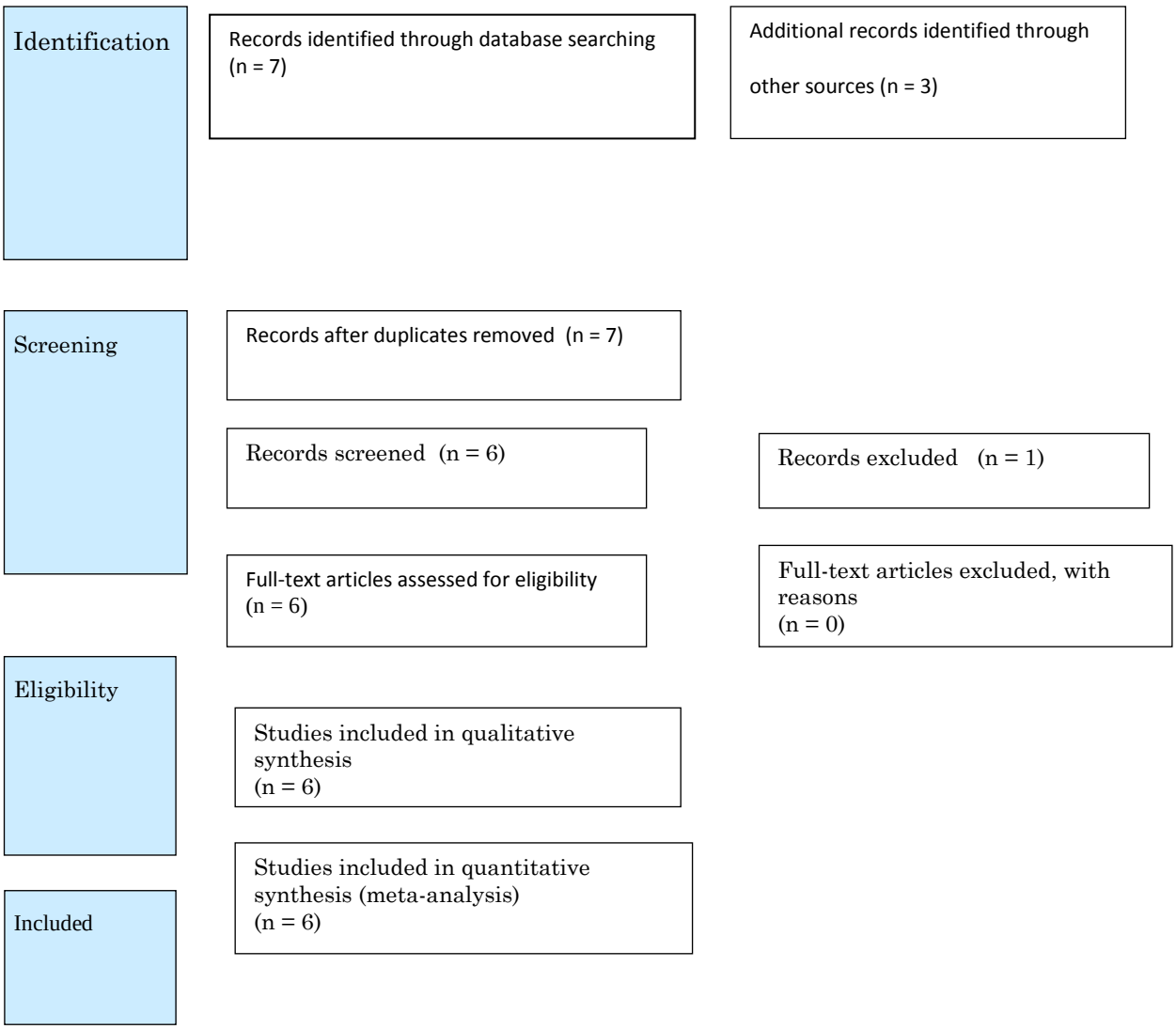

Fig. 1: PRISMA 2009 flow diagram

Table 1: Tabulation summary of significance of dorsal root ganglion neurons up regulation of superior cervical ganglion-10, growth-associated protein-43 and protein levels in of lumbar (L4-L5) spinal cord segments linked to sciatic nerve injury

Description	Source
GAP-43 plays a key function in development of a mammal's size and the development of its central system.	Margiana et al [1]
MRNAs coding for CAP-23, GAP-43 and SCG-10 were greatly upregulated by DRG neurons after ligation of the sciatic nerve.	Mason [2]
There is bilateral buildup of protein levels and GAP-43 and SCG-10 mRNA in DRG neurons associated with injured nerve.	Dubový [3]
S96 site of GAP-43 was the highest phosphorylated site, highly proline-directed, are those that regulated growth of nerves.	Kawasaki et al [6]
PI3K is highly efficient in the regulating of the whole process of neuronal regeneration.	Margiana et al. [1]
Their data indicated that the regulation of metabolic enzymes met the DRG cells alteration requirement.	Komori's [3]

Conclusion

GAP-43 plays a key function in peripheral nerve regeneration. Not onlt GAP-43 playing the important role in peripheral nerve regeneration, but also CAP-23 dan SCG-10 must working orchestratedly in peripheral nerve regeneration, especially in axonal growth.

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