Neuronal activation in Nucleus Tractus Solitarius and Area Postrema of young and aged female rats induced by hypotension

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INTRODUCTION

- Changes in blood pressure alter baroreceptor input to the Nucleus Tractus Solitarius (NTS), activating neurons that, in turn, modify autonomic function to restore blood pressure to normal levels
- Changes in blood pressure alter hormonal input to the Area Postrema (AP)
- Age affects blood pressure and responses to blood pressure changes, especially in females
- Few studies have investigated effects of aging on blood pressure control in animal models, and almost none examined aged females

GOALS

- Analyze activated neurons in the NTS and AP of young and aged female rats after experimental hypotension using immunolabeling for Fos, the protein product of the proto-oncogene, c-Fos

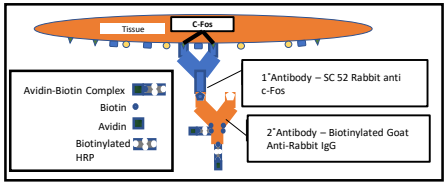
METHODS

As part of ongoing studies, reproductively intact, young (5 months; n = 9) and aged (25 months; n = 9) female brown Norway rats were injected s.c. with Isoproterenol (ISOP; 30 µg/kg) or vehicle (0.15 M NaCl; 750 µg/kg).

- 90 minutes after ISOP/vehicle, rats were deeply anesthetized and then perfused with paraformaldehyde.
- Brains were removed, sectioned at 40 µm using a cryostat, and stored in cryoprotectant.

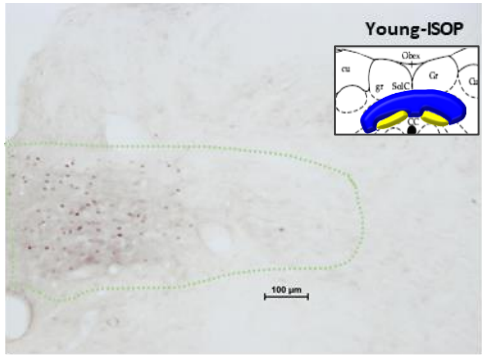
Immunohistochemistry (IHC) was used in the current study

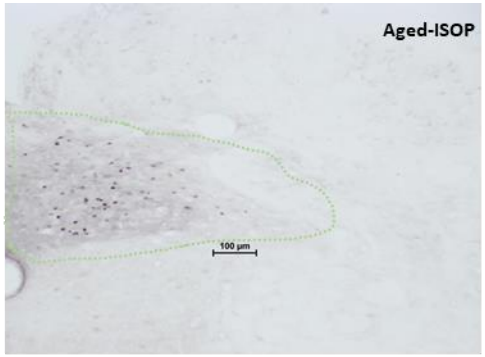
- Free-floating hind brain sections were processed for Fos (Santa Cruz; Rabbit Anti-c-Fos; 1:20,000)

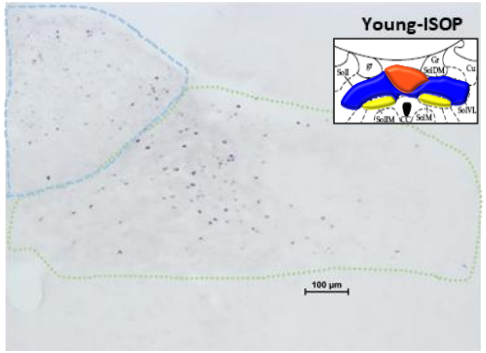


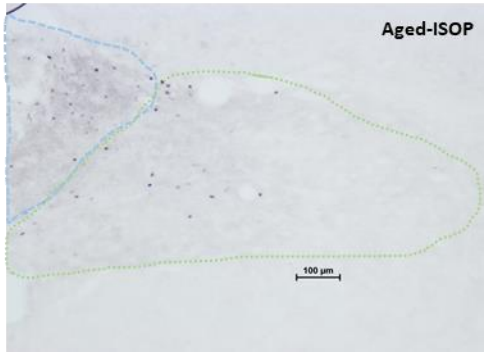
- Immunolabeled sections were ordered, mounted on slides, and coverslipped
- The NTS and AP were identified under brightfield microscopy. Immunolabeling was quantified in the caudal and middle NTS (cNTS, mNTS), and AP using NIS Elements.

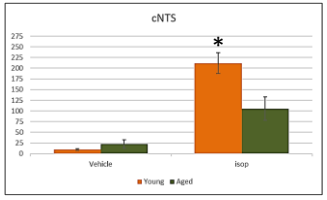
RESULTS

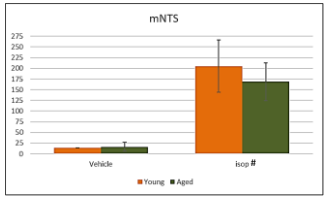


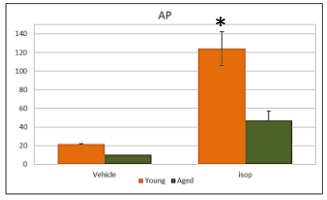












*= significantly greater than aged isop (p<.01) #= significantly greater than vehicle (p<.01)

SUMMARY

ISOP

- Overall, the greatest increases in Fos immunolabeling were due to ISOP
- Numbers of Fos+ nuclei in the AP and cNTS were reduced in aged females
- Numbers of Fos+ nuclei in the mNTS did not differ with age

VEH

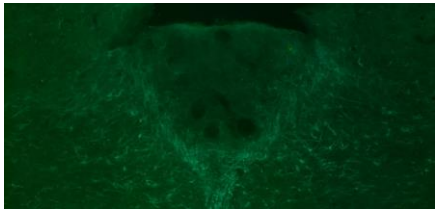
- Numbers of Fos+ nuclei were not different in either area

CONCLUSIONS

Baroreceptor inputs terminate in the caudal NTS. Thus, attenuated Fos expression in the caudal NTS and AP of aged female rats may indicate reduced responsiveness to hormonal and baroreceptor signals. These changes may alter cardiovascular regulation in aged females.

FUTURE STUDIES

- Determine the phenotypes of activated neurons in the NTS; ongoing work is examining norepinephrine as a possible candidate
- Ongoing work assessing astrocyte activation to determine the contribution of non-neuronal cells (IHC labeling shown below)



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