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THE PONTINE MICTURITION CENTER MAYBE CONTROL THE PREGANGLIONIC NEURONS OF SYMPATHETIC NERVE THROUGH THE INTERNEURONS

Hypothesis / aims of study

To study morphologic relationship of the pontine micturition center(PMC) and the preganglionic neurons of sympathetic nerve(SPNs) and whether there are some evidence that the PMC control micturition through parasympathetic ,pudendal nerve ,and sympathetic nerve as well.

Study design, materials and methods

In 9 male SD rats, 10% biotinylated dextran amine(BDA,Molecular probs,3,000 molecular weight,dissolved in 0.1M PB,pH 7.3) was injected stereotaxically into the right dorsolateral pons by iontophoresis through a glass micropipette(internal tip diameter 15-20μm).After a survival period period of 11 days,the rats were anesthetized again,and 30% Horseradish peroxidase HRP Sigma were made into the area where the right SPNs located .After 2 days,the rats were perfused.L6-S1cord were take out to detecting the BDA labelled terminals using ABC methods and the HRP retrograde neurons by the tetramethylbenzidine(TMB) method in the L6-S1 spinal cord . The preganglionic parasympathetic neurons(PPNs) were identified by immunohistochemical method using rabbit anti-choline acetyltransferase(1:4000; Calbiochem).The pons and L1-L2 cord were detected as well to confirm the accuracy of the injection .

Another group of rats(2 femals,3 males), 4% wheat germ agglutinin-horseradish peroxidase WGA-HRP Sigma was injected into the right sacral parasympathetic nucleus(SPN) in L6-S1 cord.After a survival of 2 days, the rats were perfused and the L1-L2 segments were take out to detect the antegrade terminals .

Results

In first group of rats,HRP was strictly injected into the right SPN of L1-L2 cord of every rat. Six 0f the ninerats,BDA was injected in the PMC mainly,each of these rats,there are many BDA-labelled terminals located in L6-S1 segment,and mainly lie in bilateral intermediolateral cell column(IML) of L6-S1 cord where the sacral parasympathetic nucleus(SPN) located,with a slight dominance on the side ipsilateral to the jection,but it is a little difference between these rats. Two of six rats the BDA completely in PMC,the terminals were strictly located in the IML of the L6-S1 segment.The other 4 of the six ,the BDA mainly in PMC,but the BDA was expanded to the locus ceruleus in 3 rats,and extended to D-region in one rat. Similarly there are no terminals were seen outside the bilateral IML in the three rats,but there are some BDA labelled terminals outside the IML and expand to the dorsal commissure in the rat that the BDA extended to D-region. All of these 6 rats have no typical retrograde BDA-labelled neurons located in SPN,and some slides show the BDA-labelled terninals have synaptic contact with the HRP-labelled neuron. Additionally, there are many horseradish peroxidase (HRP) labelled neurons located dorsal to PPNs,and they are not choline acetyltransferase-immunoreactive(ChAT-IR) and smaller than PPNs significantly($P<0.05$).BDA-labelled terminals were located mainly in the bilateral intermediolateral cell column(IML) of L6-S1 cord,and there are some terninals have synaptic contact with the HRP-labelled neurons. In addition,there are some WGA-HRP labelled terminals in the ipsilateral intermediolateral cell column(IML) where SPNs located in L1-L2 segment to the injection after WGA-HRP being injected into the SPN.

Interpretation of results

In this experiment,there are many retrograde neurons which were not ChAT-IR located in ipsilaternal SPN after HRP was injected into the right IML of L1-L2 cord,and these neurons are mainly lies dorsalto the PPNs in SPN which were ChAT-IR. Moreover,these neurons are smaller than the of the parasympathetic nerve which are ChAT-IR morphologically.So,the

HRP-labelled neurons should be interneurons. Additionally,there are many WGA-HRP-labelled terminals located in the right IML of L1-L2 cord after WGA-HRP was made into the right SPN. On the other hand,the results shows there are many BDA-labelled terminals located in bilateral SPN,and some right terminals have synaptic contact with the interneurons located dorsal to the SPN which retrogradely labeled after HRP was injected into the right IML of L1-L2 cord.

When the bladder is full and ready to be emptied,higher brain centers (periaqueductal gray) signal the PMC in pons ,or the sensation of the distention ascend to to PMC directly(1).The neurons in PMC run to the SPN(2),where they synapse on neurons of the bladder motoneurons which cause the bladder muscle contraction .The relaxation of the urethral sphincter during micturition is caused by a direct PMC projection to sacral inhibitory interneurons in the dorsal gray commisurewhich in turn, inhibit sphincter motoneurons in Onuf's nucleus during micturition(3).

Based on the results of this study,presumably some of the terminals synapse on interneurons located dorsal to the SPN,then these internurons could effect(maybe inhibit) SPNs to relax the bladder neck and the internal urethral sphincter during micturition.So the coordination of the pelvic,hypogastric and pudendal nerve during the micturition was achieved.

Concluding message

PMC maybe control the preganglionic neurons of sympathetic nerve through the interneurons located dorsal to PPNs during the micturition.

References

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