Impact of central nervous system alterations to bladder dysfunction in elderly people

M. Schmidbauer

Department of Neurology, Lainz Hospital, Vienna, Austria

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1. Introduction

Regardless of 150 years of progression in the neurosciences, neurogenic control of micturation is not fully understood. This is due to the methods of research in correlative neurology, which are not in all instances satisfactory for defining central vegetative control functions, including the mechanisms involved in bladder control:

- A “nucleus” composed of grey matter has to be localized exactly whenever stimulation is intended to uncover its function or ablation is intended to erase function. This is possible only when a nucleus is well delineated but not possible in diffusely circumscribed grey masses.
- Fibre degeneration following a lesion is an approach to the interconnections between respective nuclei or other circumscribed areas of grey matter. By using this “Wallerian” degeneration, efferent fibre tracts can be traced from a damaged area of origin to the target area as far as a representative proportion...
of fibres are well myelinated, since myelin breakdown products subserve as "tracers" along the course of degenerating fibres. Clinical case studies are commonly based on this "lesion method" and Wallerian degeneration.

- Experimental tracer studies and transmitter mapping are further main tools in the general spectrum of neuroscientific research.

With regard to the central nervous control of bladder function, many problems remain beyond the scope of this approach:

- Many components in the network of bladder control are located in the brainstem and form part of the reticular formation (RF) (Nieuwenhuys et al. 1988). They are loosely scattered arrangements of nerve cells, by no means sharply demarcated, definite nuclei, and they exhibit multidirected fibre connections as the common hallmark of systems subserving multimodal integration. Their fibres are typically thin and mainly unmyelinated (Nieuwenhuys et al. 1998). They are therefore not suitable for the lesion method using Wallerian degeneration.
- Stimulation with microelectrodes or ablation in animal models are rather unselective when the anatomical target to electrode insertion is indistinct.
- Clinical tests on bladder function in acute CNS lesions are hampered, when permanent catheters in patients are necessary due to impaired consciousness or the need of permanent fluid balance control.
- Pharmacological side effects of various individual medications on bladder function is a routine problem (Müller-Oerlinghausen et al. 1999).
- Studies on human lesions are often restricted to rare cases; impacts on general conclusions are doubtful.

Table 1. Central nervous system structures affiliated to bladder function (according to Appenzeller)

<table>
<thead>
<tr>
<th>Telencephalon</th>
<th>Support of bladder contraction</th>
<th>Support of bladder relaxation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caudal Gyrus cinguli</td>
<td></td>
<td>Caudal Hypothalamus</td>
</tr>
<tr>
<td>Caudal Cingulum</td>
<td></td>
<td>Caudal Hypothalamus</td>
</tr>
<tr>
<td>Diencephalon</td>
<td>Lateral/caudal Hypothalamus</td>
<td>Vicinity of contraction</td>
</tr>
<tr>
<td>Stria terminalis</td>
<td>Commissura anterior</td>
<td>supporting mesencephalic</td>
</tr>
<tr>
<td>Nucleus Praeopticus</td>
<td>Ventral septum</td>
<td>area</td>
</tr>
<tr>
<td>Mesencephalon</td>
<td>Colliculus superior</td>
<td>Tegmental RF</td>
</tr>
<tr>
<td>Area intercolliclaris</td>
<td>Central gray matter</td>
<td></td>
</tr>
<tr>
<td>Tegmental RF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pons</td>
<td>Dorsolateral RF</td>
<td>Ventrolateral RF</td>
</tr>
<tr>
<td>Medulla oblongata</td>
<td>Bulbar center of bladder</td>
<td></td>
</tr>
<tr>
<td>contraction, tegmentum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebellum</td>
<td>Nucleus fastigii</td>
<td></td>
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<tr>
<td></td>
<td>Nucleus globosus</td>
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</tr>
<tr>
<td></td>
<td>Nucleus emboliformis</td>
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