Voiding dysfunctions in patient with brain injury: Systematic literature review

Disfunciones de la micción en pacientes con lesión cerebral: Revisión sistemática de la literatura

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Conflict of interest: The authors declare no conflicts of interest.

Resumen

Introducción: Las disfunciones miccionales incluyen una serie de signos y síntomas relacionados con el tracto urinario inferior, lo que repercute negativamente en la calidad de vida de las personas. **Métodos:** Revisión sistemática de la literatura, según los lineamientos del protocolo PRISMA, utilizando las bases de datos PUBMED, Scielo y Google Scholar. Al monto de selección se le sumaron todos los estudios relacionados - "Disfunciones miccionales entre pacientes con lesiones intracraneales expansivas", publicados entre 1964 hasta marzo/2020. **Resultados:** Se encontró mayor prevalencia de casos en mujeres, con algunas lesiones como meningioma, destacando aneurismas y quistes. En cuanto a las disfunciones miccionales, existe una incidencia predominante de incontinencia urinaria seguida de enuresis. Como síntomas prevalecieron el déficit de la marcha, el dolor de cabeza, el déficit de memoria y la desorientación. **Discusión:** La participación de la protuberancia en el control de la micción es notoria, se han realizado estudios de laboratorio que indican la existencia de un centro supramedular capaz de controlar la micción, denominándose centro pontino de la micción, también llamado núcleo de Barrington. **Conclusión:** La incontinencia urinaria muchas veces es ignorada en cuanto a su etiología porque se asocia con inmovilización, aislamiento social, distorsión de la imagen y condiciones depresivas, disminuyendo la calidad de vida del paciente. Por lo tanto, debe tenerse claro que las lesiones intracraneales expansivas pueden ser una posible causa de disfunciones miccionales y deben investigarse en condiciones cuya asociación causa-consecuencia pueda comprenderse. Además, es fundamental desarrollar más estudios que busquen comprender los mecanismos centrales de la micción.

Palabras clave: Incontinencia urinaria, Síntomas del tracto urinario inferior, Lesión intracraneal, Lesión cerebral, Lesiones que ocupan espacio.

Abstract

Introduction: Voiding dysfunctions includes a series of signs and symptoms related to the lower urinary tract, which has a negative impact on people's quality of life. **Methods:** A systematic review of the literature, according to the guidelines of the PRISMA protocol, using the databases PUBMED, Scielo and Google Scholar. All studies related - " Voiding dysfunctions among patients with expansive intracranial lesions" - were added to the amount for selection, published between 1964 until March/2020. **Results:** A higher prevalence of cases was found in women, with some injuries such as meningioma,

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aneurysms and cysts standing out. Regarding voiding dysfunctions, there is a predominant incidence of urinary incontinence followed by enuresis. As symptoms, gait deficit, headache, memory deficit and disorientation were prevalent. **Discussion:** The participation of the pons in the control of urination is notorious, been conducted studies at laboratory, indicating the existence of a supra-medullary center capable of controlling urination being called the pontine center of urination, also called Barrington's nucleus. **Conclusion:** Urinary incontinence is often neglected in terms of its etiology because it is associated with immobilization, social isolation, image distortion and depressive conditions, decreasing the patient's quality of life. Thus, must be clear in mind that expansive intracranial lesions may be a possible cause of voiding dysfunctions and should be investigated in conditions whose cause-consequence association can be understood. In addition, it is essential to develop further studies seeking to understand the central mechanisms of micturition.

Key words: Urinary incontinence, lower urinary tract symptoms, intracranial injury, brain injury, space occupying injuries.

Introduction

Voiding dysfunctions include a series of signs and symptoms related to the lower urinary tract, that contains varying etiology. This condition affects millions of people around the world[77] and, given the stigma related to the condition, it affects people's quality of life. Both function and voiding dysfunction are related to a series of structures, including some brain structures[65]. Rarely, patients associate symptoms related to urinary dysfunction with a neurological disorder[59], nevertheless injuries located to centers located in the central and peripheral nervous system can cause this problem.

Related to the bladder function, which is particularly complex, it basically corresponds to two functions: storage and emptying[14,36], coordinated by existing connections between suprapontine structures and the bladder[23]. Several reports involving voiding dysfunction involve patients with expansive intracranial lesions[59], which can be caused by a variety of diseases, including primary and secondary neoplasms, cysts, hematomas, abscesses, aneurysms and vascular malformations[67]. Cortical control of micturition still poorly understood[17], however a series of case reports, as well as experimental studies with animals and imaging exams, discussed below, presents, in summary, the role of intracranial structures in the control of micturition.

The objective of the present study is, based on a systematic review of the literature, to identify articles about patients with expansive intracranial lesions who presented in their clinical picture some urinary disorder, to contribute to the elucidation of the brain mechanisms that involve micturition control.

Methods

The present work is a systematic review of the literature, according to the guidelines of the PRISMA protocol[44], for this purpose, were used the following databases: PUBMED, Scielo and Google Scholar. The research included articles published from 1964 until March 2020. The keywords used for systematic research were: "intracranial lesion", "brain tumor", "frontal lobe", "incontinence", "urgency", "continence", "LUTS", "urinary retention". All studies, including case reports and systematic reviews, conducted with any population, age, sex, which were related to the theme - "Voiding dysfunctions among patients with expansive intracranial lesions" - were added to the amount for selection. Exclusion criteria were the following factors: publications dealing with extracranial lesions, as well as articles not completely available. To understanding the selected literature, only works published in the following languages: English, Spanish and Portuguese were added.

Results

In total, 40 case report studies were selected from among the 75 eligible studies collected from the databases (Figura 1). The patients reported among the recovered articles, who had expansive intracranial lesions associated with urinary disorders are listed in Table 1. The total number of cases present among the case reports was 66. The ages ranged between 5 and 87 years old, with the average of 55.4 years. Among the 66 cases, 36 (55%) were female and 30 (45%) were male.

The most common injuries, in absolute numbers, were meningioma[13], aneurysms[8], cysts[6], glioblastomas[6], gliomas[6], schwannomas[6], adenomas[4], astrocytomas[4], oligodendrogliomas[3] and hemorrhagic lesions[3]. Among the less common lesions are hemangioma[1], meningoencephalitis[1], lung carcinoma metastasis[1], neurocytoma[1], pineocytoma[1], subependimoma, carcinoid tumor, solitary fibrous tumor, unspecified pituitary tumor.

Regarding the location of the lesions, the most prevalent were lodged in the frontal lobe, comprising a total of 26 patients, of whom, 15 had lesions located only in the right frontal lobe, 8 in the left lobe and 3 in both lobes. Then, the most common locations observed were: III ventricle[7], near the corpus callosum[6], pituitary gland[4], cerebellar tentacle[3], olfactory fossa[2], foramen of Monro[2], fornix[2], pineal gland[2], midbrain[2], pons[2], Sella turcica[2], cerebellum[1], cingulate gyrus[1], temporal lobe[1], caudate nucleus[1], frontoparietal region[1], frontotemporal region[1], thalamus[1] and cerebellar tonsil[1]. It is worth mentioning that some patients presented lesions in more than one location.

Regarding the reported voiding dysfunctions, we have the following: urinary incontinence[52], followed by enuresis[7], urge-incontinence[6], increased frequency of micturition[5], urinary retention[3], urinary urgency[3], difficulty in urinating[2] and daytime enuresis[1]. It is worth mentioning that some patients had more than one voiding symptom.

The symptoms associated with voiding complaints were

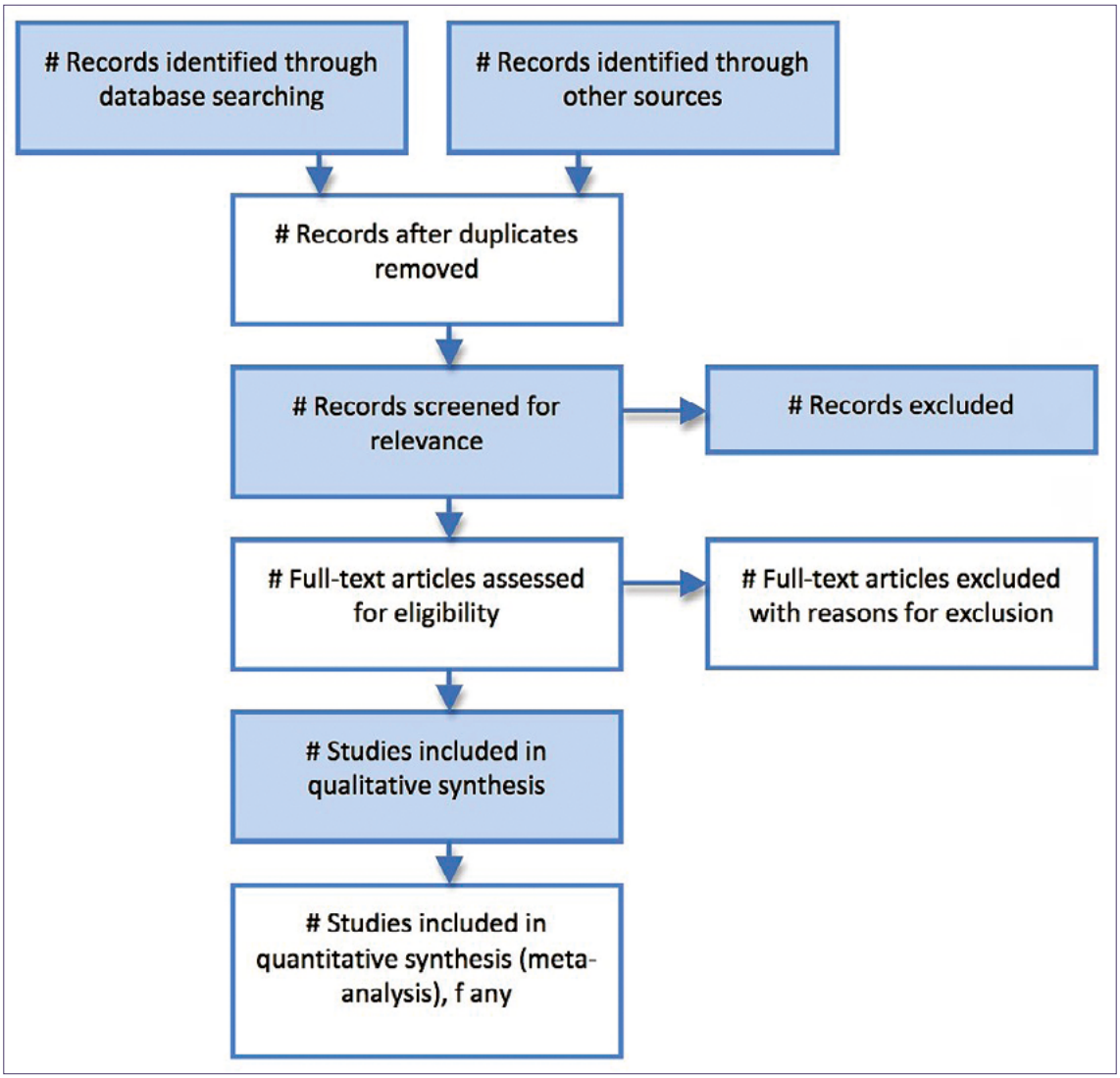

Figure 1. PRISMA flow diagram summarizing the literature search. Este archivo está licenciado bajo las licencias Creative Commons Atribución-CompartirIgual 4.0 Internacional, 3.0 Unported, 2.5 Genérica, 2.0 Genérica y 1.0 Genérica. Atribución: Atizinha.

too varied, for the purposes of synthesis they were grouped in Table 2. The most prevalent symptoms reported in addition to voiding dysfunctions were gait deficit, headache, memory deficit, disorientation, weakness, visual and behavioral changes (Table 2). Among the symptoms of deterioration in functional capacity, the most prevalent were those related to memory deficits. Of the 66 patients, 25 (37.8%) were diagnosed with hydrocephalus secondary to intracranial injury, due to obstruction of cerebrospinal fluid (CSF) flow, among which 16 (64%) underwent CSF drainage.

As for the conduct adopted in the case reports, regarding expansive neoplastic lesions, constituting a total of 50 patients, 31 (62%) underwent resection of the total or partial tumor. Among the patients who presented hematomas, all of them were submitted to drainage of the hematoma. Among the six patients who presented intracranial cyst, 5 (83.3%) underwent surgical treatment for resection of the cyst, and in one (17.7%) spontaneous remission was reported.

Among the reports presented (Table 1), 8 involved patients with aneurysms being in: basilar artery (42.8%), anterior cerebral artery (ACA) (28.6%), middle cerebral artery (14.3%) and pericallosal artery (14.3%). Still on patients with aneurysm, two reports bring about the rupture of the vessel and subsequent treatment with drainage. Among the others, the procedure adopted was occlusion (66.8%), clipping of the aneurysm neck (16.6%) and arterial embolization (16.6%).

Among the therapies adopted, in addition to surgical procedures, 6% underwent corticosteroid therapy and 3% radiotherapy. It is worth noting that in some patients the therapy adopted was multiple. Regarding the outcome of voiding symptoms, 50 patients (75.7%) had reported partial or total improvement, in contrast to 7 patients (7.6%) who remained or worsened voiding symptoms. In addition to these data, three deaths (4.5%) were reported, one of which was preceded by remission of symptoms and six (9%) did not specify the outcome of the case.

Table 1. Intracranial expansive lesions and location by author, year					
Author	**Year**	**Age**	**Sex**	**Lesion**	**Location**
Andrew et al.[3]	1964	58	F	Glioblastoma multiforme	R Frontal lobe
Andrew et al.[3]	1964	28	F	Glioblastoma multiforme	L Frontal lobe
Andrew et al.[3]	1964	65	M	Glioblastoma multiforme	R Frontal lobe
Andrew et al.[3]	1964	62	F	Subarachnoid hematoma	L Cingulate gyrus, corpus callosum genu
Andrew et al.[3]	1964	AT	F	Subdural hematoma	Posterior to the corpus callosum genu
Andrew et al.[3]	1964	60	F	Meningioma	L Frontal lobe
Andrew et al.[3]	1964	58	F	Meningioma	R Frontal lobe
Andrew et al.[3]	1964	50	F	Meningioma	R Frontal lobe
Andrew et al.[3]	1964	38	F	Meningioma	Frontal lobe
Andrew et al.[3]	1964	57	M	Meningioma	R Frontal lobe
Andrew et al.[3]	1964	52	M	Meningioma	L Frontal lobe
Andrew et al.[3]	1964	34	M	Oligodendroglioma	R Frontal lobe
Hunter et al.[33]	1968	65	F	Meningioma	Frontal lobe
Ehrlich et al.[19]	1973	38	F	Oligodendroglioma	L Temporal lobe
Maurice et al.[47]	1974	52	F	Glioblastoma multiforme	R Frontal lobe
Maurice et al.[47]	1974	60	M	Glioma	R Frontal lobe
Maurice et al.[47]	1974	51	F	Malignant glioma	L Frontal lobe
Maurice et al.[47]	1974	57	M	Malignant glioma	R Frontal lobe
Maurice et al.[47]	1974	40	M	Malignant glioma	R Frontal lobe , corpus callosum
Maurice et al.[47]	1974	68	F	Meningioma	R Frontal lobe
Maurice et al.[47]	1974	48	M	Oligodendroglioma	R Frontal lobe adjacent to the corpus callosum genu
Kirschberg et al.[38]	1976	58	F	Meningioma	Cerebellar tentacle
Lindboe et al.[45]	1992	63	M	Subependinoma	Anterior portion of the corpus callosum, lower portion of the III ventricle and pellucid septum
Manente et al.[46]	1996	69	F	Low-grade glioma	Pons
Soler et al.[66]	1998	8	AT	Pilocytic astrocytoma (Grade I)	Cerebellum and midbrain
Soler et al.[66]	1998	5	AT	Pilocytic astrocytoma (Grade I)	Pons
Duru et al.[18]	1999	65	F	Pituitary tumor	Pituitary gland, Sella Turcica, III ventricle
Sakakibara et al.[60]	2000	30	M	Meningoencephalitis	Frontal lobe
Motoyama et al.[50]	2002	83	M	Colloid cyst	III ventricle
Hirato et al.[32]	2002	46	M	Giant cell glioblastoma	L Frontal lobe, basal ganglia, thalamus, corpus callosum, wall of the III ventricle
Prayson et al.[56]	2002	87	F	Syncytial meningioma and malignant astrocytoma	R Frontal lobe
Nakajima et al.[52]	2003	49	F	Chordoid glioma	III ventricle
Bloch et al.[9]	2003	77	F	Vestibular Schwanoma	AT
Bloch et al.[9]	2003	77	F	Vestibular Schwanoma	AT
Bloch et al.[9]	2003	71	F	Vestibular Schwanoma	AT

Bloch et al.[9]	2003	79	M	Vestibular Schwanoma	AT
Bloch et al.[9]	2003	77	M	Vestibular Schwanoma	AT
Bloch et al.[9]	2003	75	M	Vestibular Schwanoma	AT
Hamada et al.[29]	2004	60	F	Astrocytoma (Grade II)	L Head of the caudate nucleus, fornix
Yaguchi et al.[79]	2004	31	M	AT	Periaqueductal Gray Substance
Deshaies et al.[16]	2004	79	F	Carcinoid tumor	R Frontal lobe
Yamamoto et al.[80]	2005	60	M	Adenoma	Pituitary Gland
Yamamoto et al.[80]	2005	62	M	Adenoma	Pituitary Gland
Yamamoto et al.[80]	2005	28	M	Adenoma	Pituitary Gland
Noble et al.[53]	2005	75	M	Glioblastoma multiforme	L Frontal lobe, L inner capsule, fornix
Güzel et al.[28]	2007	56	M	Adenoma and arachnoid cyst	Sella Turcica
Tsutsumi et al.[71]	2008	58	M	Basilar artery aneurysm	III ventricle
Wallace et al.[75]	2008	74	F	Dermoid cyst	Cerebellar tonsil
Kinfe et al.[37]	2008	75	F	Solitary fibrous tumor	Monro's foramen
Abdel et al.[1]	2010	73	M	Subdural hematoma	L Frontoparietal region
Hanada et al.[30]	2010	69	M	Lung carcinoma metastasis	Pineal gland
Rocha et al.[57]	2012	77	F	Meningioma	R Frontal lobe
Gempt et al.[27]	2012	31	M	Pineocytoma	Pineal gland
Castro et. al.[12]	2013	67	M	Aneurysm of the anterior cerebral artery	III ventricle
Lauretti et al.[43]	2015	82	F	Cyst	Cerebellar tentacle
Lauretti et al.[43]	2015	41	F	Cyst	Cerebellar tentacle
Okorji et al.[54]	2016	28	M	Middle cerebral artery aneurysm	L Frontotemporal region
Pranckeviciene et al.[55]	2016	58	M	Meningothelial meningioma	Olfactory fossa
Feletti et al.[20]	2017	62	F	Cavernous hemangioma	Cerebral aqueduct
Kamtchum-Tatuene et al.[35]	2017	42	F	Meningothelial meningioma	Olfactory fossa
Xin et al.[78]	2018	12	M	Venous aneurysm	L Middle cerebral artery
Chen et al.[13]	2018	59	F	Extra ventricular neurocytoma	L Frontal lobe
Bouty et al.[10]	2018	9	F	Neurofibroma	Posterior fossa
Viaene et al.[74]	2019	47	F	Neuroenteric cysts	Cerebromedular angle
García-Pérez et al.[26]	2020	64	F	Basilar artery aneurysm	Midbrain
Kalousek et al.[34]	2020	62	F	Basilar artery aneurysm	Monro's foramen
F: Female; M: Male; L: Left; R: Right; AT: Absent.					

Discussion

Barrington, through animal studies, found the importance of the pons in controlling micturition, when studying lesions in the dorsal region of the pons, which caused an inability to empty the bladder[6,21,22]. Similar results were observed in studies carried out with rats, reaffirming the hypothesis of the existence of a supra-medullary center capable of controlling micturition[64]. This region, formerly known as the pontine micturition center, became known as the Barrington's nucleus, responsible for sending signals to the sacral medulla via neuronal projections to coordinate bladder contraction with external urethral sphincter relaxation, thereby promoting micturition[70].

A series of studies have found that the activation of the nucleus (through electrical currents or use of glutamate), result in micturition, while the inhibition or injury of this nucleus promotes urinary retention[73].

Ueki et al.[72], in 1960, observed from studies a strong influence of areas such as the pons and the frontal lobe in the control of micturition, suggesting that the posterior area of the midbrain would possibly not be important for the center of micturition. Andrew & Nathan[3,4], reported several groups of cases of patients with intracranial lesions that presented voi-

Table 2. Symptoms associated with voiding dysfunction, by number of patients

Symptom	n of patients
Walking Deficit	19
Headache	18
Memory Deficit	16
Confusion/Disorientation	12
Weakness	11
Visual Changes	11
Behavioral Change	9
Dizziness/Imbalance	8
Hemiparesis	7
Somnolence	6
Babinski Positive	6
Epileptic Seizures	5
Insanity	5
Emesis	5
Hypoacusis	5
Cognitive Deficit	5
Aggressiveness/Irritability	4
Apathy	4
Loss of consciousness	4
Hallucination	3
Anosmia	3
Concentration Difficulty	3
Nausea	3
Alteration of Ocular Motricity	2
Cold	2
Language Deficit	2
Dysphagia	2
Dysphasia	2
Fecal Incontinence	2
Weight loss	2
Sensory Deficit	1
Diarrhea	1
Dysarthria	1
Leg Pain	1
Fever	1
Hypophony	1
Slowness of Movements	1
Quadriparesis	1
Rigidity	1
Syncope	1
Tremor	1

ding dysfunction, concluding that lesions in the superomedial region of the frontal lobe could cause disorders of micturition and eventually defecation[3]. Some authors[33,38], posteriorly reported the association of urinary incontinence with deterioration of personality and loss of social sense, impacting the admission of these patients to psychiatric hospitals, often with the diagnosis of dementia.

Ehrlich et al.[19], reported a case of urinary incontinence secondary to epileptic discharges caused by the presence of expansive intracranial injury, as well as from stress tests with saline solution, they observed that the bladder became unable to control micturition after reaching a certain volume, there is no direct relationship with the patient's efforts. The mechanisms that support voiding normality go beyond the simple sacral reflex, being it also dependent on supraspinatus pathways[8,47,70], which are related to the facilitation and inhibition of the micturition reflex[41,58]. The spino-bulb-spinal micturition reflex acts in a tonic manner, receiving inhibitory influence from supra-pontine structures that include the hypothalamus[80].

Micturition involves the performance of complex spinal pathways, as well as a supraspinatus architecture[77]. During urine storage, signals from bladder distension ascend through the spinal cord and reach the periaqueductal gray substance, which sends projections to the hypothalamus and thalamus. Then, the transmission route continues reaching the posterior portion of the anterior cingulate gyrus and lobe of the insula on the right, only then does the prefrontal medial cortex process the information and make the decision regarding the effectiveness of the voiding act, exciting or inhibiting the pontine center of voiding, since communication with the periaqueductal gray substance[25,80]. Furthermore, the expansive lesions addressed can occur at any age, in adults specifically, the most frequent location is the frontal lobes and less frequently the temporal lobes[42].

Fowler et al.[24], carried out a review where they pointed out the neurological disorders that can cause lower urinary tract dysfunction and among them: supra-pontine lesions, hydrocephalus, normal pressure hydrocephalus, neoplasms, and vascular causes. The current study gathered reports of various lesions, particularly neoplastic lesions, which accounted for 75.7% of intracranial lesions with associated urinary disorders, followed by aneurysms, cysts, hemorrhagic lesions, and other unspecified lesions. Damage to the cerebral cortex such as that caused by tumors, aneurysms and other cerebrovascular diseases removes the inhibitory control of the structures located on the pons around micturition, which can cause overactive bladder[14].

The role of the frontal lobe in controlling micturition has been observed since studies in the 1960s, with several in the literature[3,4,31,33,39,47,51,59,68,72]. Ueki et al.[72], observed that the incidence of voiding dysfunctions among patients undergoing frontal lobectomy was higher, being even more frequent among patients undergoing left frontal lobectomy.

In the present study, the prevalence of involvement of the right frontal lobe was observed among patients with voiding complaints. The findings by Sakakibara et al.[63], in their studies reinforce the idea that there is a predominance of the right hemisphere in micturition. Mochizuki & Saito[49] found that lesions located in the right prefrontal region promoted transient urinary symptoms, in contrast to bilateral lesions, which caused

permanent symptoms.

The prefrontal cortex constitutes the complex cognitive center, associated with adequate moral and social behavior and personality. Thus, it is observed that when affecting such an area there is the possibility of promoting deterioration of intellectual capacity, which includes deficits in memory, language, visual and behavioral functions[53]. It is worth noting that there are no reports of bladder dysfunction in the literature as a result of a single and/or focal deficit in the lobes: parietal, temporal or occipital[59]. According to Campagnolo et al.[11], urinary incontinence was not more prevalent in the population with injury to the frontal lobe than among those with lesions not located in that same lobe, with a diversity of locations that could lead to the same clinical picture.

In the case of cerebral cortex activity, significant activity is noted in the anterior portion of the cingulate gyrus[23], which has several connections with mesencephalic structures, insula and prefrontal region. It is involved in the cognitive process related to the attention and control of performance, thus relating to the perception of bladder filling and the appropriate moment for the voiding act[17,36], and the crown and the superior fronto-occipital fascicle may be involved in this role[40].

There are several types of urinary incontinence which can be distinguished according to the symptoms presented by the patient, including: triggered by stress, urge incontinence, mixed, overflow, insensitive, situational, continuous and functional[77]. In contrast to spinal injuries, intracranial injuries typically cause urge incontinence, not urinary retention[70]. The cases of urinary retention[46,79] are reported in Table 1.

Based on the case presented by Lindboe et al.[45], it is understood that the clinical picture with voiding dysfunction may appear secondary to the expansive lesion, such as through cerebrospinal fluid obstruction (CSF). In the current study, we discovered that 37.8% of the patients listed in Table 1 had hydrocephalus due to CSF obstruction. It is reasonable to recognize that normal pressure hydrocephalus tends to affect the cerebral white matter adjacent to the dilated ventricles first, with frontal hypoperfusion being relevant in voiding symptoms due to dysfunction of the white matter's frontal descending pathways, particularly thalamic radiation[63,76].

Beez et al.[7], in a retrospective review of patients with high-grade gliomas, reported success in the treatment from ventriculoperitoneal shunt, with improvement of hydrocephalic symptoms over a 4-month period, with a low complication rate, indicating that this is an effective strategy to treat the symptoms.

Akhavan-Sigari et al.[2], found that signs of increased intracranial pressure were more common in patients with chordomas located at the base of the skull compressing the midbrain and the cerebral aqueduct, presenting with associated voiding complaints. An important finding was the high expression of induced nitric oxide synthase (iNOS), raising the hypothesis that nitric oxide could act as a neurotransmitter and influence the pontine center of micturition[2]. Tadic et al.[69], observed a positive correlation between the frequency of daytime urinary incontinence and urine loss with activity in: rostral and subgenual region of the anterior cingulate gyrus, insula, inferior frontal gyrus, frontal orbit cortex, dorsal and posterior region of the cingulate gyrus, parahippocampal gyrus, tunnels and parts of the parieto-temporal lobe.

In the 90s, with the advent of the functional brain image, much could be learned about bladder control[36]. To prove experimentally the performance of such regions in the voiding act, studies involving imaging exams[5,15,25,40,48,61-63] have been proving the participation of supraspinatus structures in this process. Functional magnetic resonance imaging is a useful tool in the study of the central neural pathways that regulate micturition[65], from which it is possible to demonstrate that in order to properly initiate the voiding act, it is necessary to activate certain supraspinatus areas, such as pre-spinal cortex -front, parietal and areas of cingulate gyrus.

The standard treatment for lower urinary tract symptoms (LUTS) includes the use of behavioral changes, lifestyle, training for bladder control and medications, it is noteworthy that there is no evidence to support the use of spinal and brain imaging tests in the routine of patients with urinary disorders, being restricted to restricted cases of patients with indication[54].

Sacral neuromodulation strategies and surgical interventions are also effective strategies[77]. Urologists should consider the neurological conditions among patients with urinary disorders, observing signs such as: rest tremor, speech disorders, gait changes, orthostatic hypotension, ataxia and altered perineal sensitivity[76].

A recent experimental study with the use of adult rats, made possible the discovery of a small neuronal group located in the primary motor cortex of these animals that plays an important role in controlling the efferences responsible for controlling micturition from their projections to the well-known pontine nucleus of the micturition, if confirmed in humans, this area may have potential for therapy with stimulation methods to treat urinary disorders[81].

Conclusion

Urinary incontinence is often associated with immobilization, social isolation, distortion of body image and depression, which ends up having an even greater impact on the patient's quality of life. So, as seen, expansive intracranial lesions correspond to a possible cause of voiding dysfunction. It is important to remember the continuous need to develop studies that better understand the central mechanisms of micturition, related to the pathways in the cerebral white matter, in order to improve the therapies for treating this condition.

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