ORIGINAL ARTICLE

The role of urodynamic studies in the diagnosis and treatment of patients with spina bifida

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ABSTRACT

Aim: Spina bifida (SB) is a congenital deformity that is frequently seen in infancy. Surgical treatment and clinical follow-up of patients with the diagnosis of SB are important to provide education to the patients and their relatives, to increase patient survival, to ensure that they have a more comfortable life. Neuro-urological problems are highly important for the patients in terms of both social and medical.

Materials and Methods: The medical records of patients who underwent surgery for SB and tethered cord syndrome at our clinic in the past year were retrospectively evaluated. The results of urodynamic studies of the patients were evaluated. The results of patients who underwent control urodynamic studies during the follow-up period were compared with the previous results, and their clinical courses were determined.

Results: The most frequent urodynamic changes in patients were hyperactive detrusor activity and detrusor sphincter dyssynergy preoperatively.

Conclusion: A significant improvement was observed when the results of postoperative urodynamic studies were evaluated in patients who underwent surgery for tethered cord.

Key words: Diagnosis, spina bifida, treatment, urodynamic study

Introduction

Spina bifida (SB) is a congenital deformity that is frequently seen in infancy. While its incidence varies between different societies, it is seen in 0.7–5/1000 live births.[1-3] According to the studies carried out in Turkey, this rate is between 1.5 and 2.3/1000 live births.[2,3] Neural tube defect, spinal dysraphism (SD), and SB are synonymous. Dysraphisms can be examined in two distinct forms, referred to as either open or closed. The open form can be classified as meningomyelocele, meningocele, hydrocerin meningomyelocele, and myeloschisis, whereas the closed form can be classified as spinal dermal sinus, tethered cord syndrome, diastomatomyelia, lumbosacral lipoma, neurenteric cyst, lipomeningomyelocele, and anterior meningocele.

Access this article online	
Quick Response Code:	Website: www.asianjns.org
	DOI: 10.4103/1793-5482.154872

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Before prenatal ultrasonography, SB was a pathology that could only be diagnosed at the time of birth. On the other hand, there are differences in the incidence of SD with respect to race, familial and genetic factors, and diet, as well as prominent regional differences.[1] While there is a decrease in this incidence depending on the antenatal early diagnosis and performing therapeutic abortion methods when needed, there is again an increase due to globalization and accompanying migration.[4,5]

The embryo pathogenesis of SD is still unclear. The combined defects involving each three germ layers are present during the etiopathogenesis. As a result of defects that occur during neural tube development between day 20 and day 60 after ovulation, only a minor defect may be present in the posterior vertebra elements depending on its time, or they may appear as complex lesions accompanied by additional pathologies, which progress with widespread neural disorders.[6] In addition, organ anomalies may be observed in the central nervous system and/or other systems.

Patients with intrauterine diagnosis who are monitored may be the patients who were diagnosed with congenital neural

tube defects at birth or those who revealed clinical symptoms at older ages. Surgical treatment and clinical follow-up of patients with a diagnosis of SB are important to provide education to patients and their relatives, to increase patient survival, to ensure that they have a more comfortable life, and to ensure their adaptation to the social environment.[7-10] Early closure of the primary defect is not only important for survival, but also for neuro-urological prognosis of children with open SB. Closing the spinal lesion in the 1st day of the life is demonstrated to provide an opportunity for proper urinary system functions.[4]

There are two major aims behind the neuro-urological management of children with myelodysplasia who do not have neurological deficits at lower extremities: (1) To protect, in particular, the kidneys, urinary tracts, and bladder from irreversible functional and morphological injury, and (2) to decrease the urinary symptoms to a minimum or to treat them to increase the quality-of-life of the children so that they can participate in social life.[4]

Retethering is observed in approximately one-third of the children operated for SD. This is an important cause underlying the dynamic nature of the disease.[11] When left untreated, retethering may be significant, and neuropathic bladder may deteriorate the neurourologic malfunction prognosis. On the other hand, retethering may also appear as NM as the first symptom in a considerable group of patients.[12,13]

Unfortunately, the diagnostic criteria for spinal cord tethering in children with myelodysplasia are not well-defined. Urological, neurological, or orthopedic deterioration during the follow-up continue to be the sole diagnostic indicator.

Materials and Methods

The medical records of patients who underwent surgery for SB and tethered cord syndrome at our clinic in the past year were retrospectively evaluated. The results of urodynamic studies which were performed during the monitoring and treatment of patients were examined. The results of patients who underwent control urodynamic studies during the follow-up period were compared with the previous results, and their clinical courses were determined.

Results

Neuro-urological follow-up of 41 patients who underwent surgery for open SB in the early period, and their results of early postoperative urodynamic studies were evaluated. Twenty-one patients were male, and 20 patients were female. The abnormal urodynamic findings of the patients are extremely active detrusor activity (EAD) was observed in three patients, EAD + detrusor sphincter dyssynergy (DSD) was observed in 31 patients, detrusor underactivity + sphincter underactivity was observed in two patients, hypoactive bladder + DSD was observed in one patient, and normal detrusor + DSD was observed in four patients [Table 1]. According to the second postoperative control, urodynamics results of 4 out of 42 patients, improvement from normal bladder + DSD to EAD was observed in one patient, improvement from EAD + DSD to DSD was observed in one patient, and improvement from EAD + DSD to EAD was observed in one patient. One patient did not have urodynamic change [Table 2].

Urodynamic study was done to all patients with a standard method. An urodynamic device (Dyno®, Aymed, Istanbul, Turkey) was used to measure the urodynamic parameters. A urethral cystometry catheter was introduced to the bladder to measure vesical pressures, and a rectal balloon catheter was introduced to the rectum to measure intraabdominal pressures. Perianal patch electrodes were used to measure sphincter activities. Detrusor pressures were calculated automatically by the device with substraction of vesical pressure from intraabdominal pressure giving the detrusor pressure according to the basic principle, Pvesical = Pabdominal + Pdetrusor. Sterile serum physiologic solution at room temperature was infused at a rate of 10% of expected bladder capacity ml/min and calculations were made. Any increased contractility during the filling phase of the urodynamic study was interpreted as overactive bladder activity, and any increased contractility of sphincter during the voiding phase of the study was interpreted as overactive sphincter activity and detrusor sphincter dyssynergia.

Urodynamic studies were done postoperatively in all SB patients as their lesions were closed in the newborn period.

Table 1: Early postoperative urodynamic study results

	Early postoperative urodynamic studies results in SB patients
EAD	3
EAD + DSD	31
DU + SU	2
HB + DSD	1
ND + DSD	4

EAD – Extremely active detrusor activity; DSD – Detrusor sphincter dyssynergy; DU – Detrusor underactivity; SU – Sphincter underactivity; HB – Hypoactive bladder; ND – Normal detrusor; SB – Spina bifida

Table 2: Second postoperative urodynamic study results

	Second postoperative urodynamic studies results in SB patients
ND + DSD to EAD	1
EAD + DSD to DSD	1
EAD + DSD to EAD	1
No urodynamic change	1

EAD – Extremely active detrusor activity; DSD – Detrusor sphincter dyssynergy; ND – Normal detrusor; SB – Spina bifida

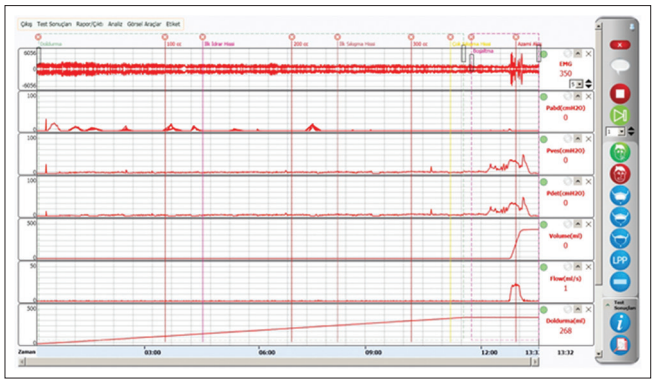

Figure 1: Normal urodynamic test

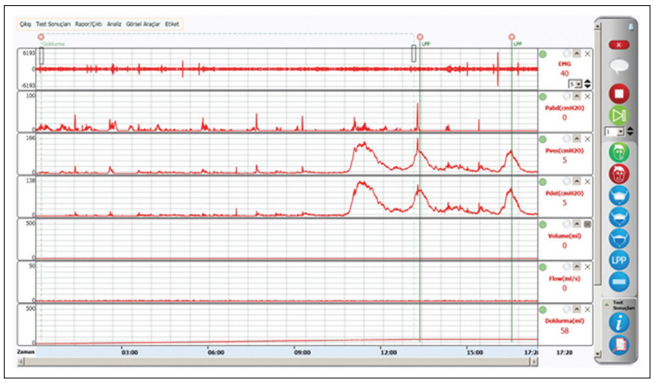

Figure 2: This urodynamic test resulted extremely active detrusor activity and detrusor sphincter dyssynergy

Preoperative urodynamic studies could be done in all tethered cord patients. Routinely, their control urodynamic studies were done 3 months and 9 months after tethered cord release operation as a part of our follow-up protocol.

Neuro-urological follow-up of 25 patients who underwent surgery for tethered cord (6 of them diastematomyelia, 4 of them fatty filum, 15 of them tight filum) between the same dates was performed, and their pre-and postoperative urodynamics results were evaluated. 11 patients were male, and 14 patients were female. In the urodynamics results of patients who underwent surgery for tethered cord, EAD was observed in seven patients, EAD + DSD was observed in seven patients, DSD was observed in four patients, and normal urodynamics were observed in seven patients. According to the postoperative urodynamics results of four patients, an improvement from EAD to DSD was observed in one patient, improvement from EAD to normal urodynamics was observed in one patient, and improvement from EAD + DSD to decreased intra-bladder pressure compared to preoperative urodynamics was observed in one patient. There was no change in the normal urodynamics result in one patient.

Discussion

Various urination disorders develop as a result of abnormal development of the spinal tube and anomalies in the innervation of the detrusor smooth muscle and urethral sphincter. The mechanical tethering of the spinal cord results in the impairment of the blood flow in the nervous tissue, and subsequent ischemia causes progressive neurological deficit.[11] Leg deformities caused by loss of sense and loss of strength and muscle imbalance are present. There are two major aims behind the neuro-urological management of children with myelodysplasia who do not have neurological deficits: (1) To protect, in particular, the kidneys, urinary tracts, and bladder from irreversible functional and morphological injury, and (2) to decrease the urinary symptoms to a minimum or to treat them to increase the life quality of children so that they can participate in society.[11] However, only NM may appear as the first symptom during retethering in a majority of the patients.[12] The result of the retethering surgery is not always predictable. The success of any secondary retethering surgery depends on good timing. By performing surgery prior to ischemia and irreversible injury, the innervation of the lower urinary system is protected. Therefore, close urological monitoring continues to be the most valuable tool as better outcomes are obtained with early diagnosis [Figures 1 and 2]. In a study that supported this hypothesis, secondary tethering was observed in 56 out of 401 children (14%) with SD Urological deterioration was observed in 58% of the patients with secondary tethering and neuro orthopedic deterioration was observed in 42% of the patients with secondary tethering. When preoperative and postoperative month six urological findings were compared, diagnosis and treatment before the age of 7 resulted in an improvement in the results of the urodynamics, as well as clinical symptoms and findings of the patients.[13]

Conclusion

An improvement in the urodynamics of three of four patients who were operated on for tethered spinal cord syndrome and who underwent second control urodynamics was observed. While the number of patients and urodynamics studies is still insufficient, early- and late-stage urodynamics studies during the clinical follow-up of patients, who underwent SB and tethered cord surgery, are important to determine the development of neuropathic bladder, tethered cord, and/or retethering, and these studies should be performed using larger patient groups.

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How to cite this article: Alatas I, Demirci H, Canaz H, Akdemir O, Baydin S, Ozel K. The role of urodynamic studies in the diagnosis and treatment of patients with spina bifida. Asian J Neurosurg 2015;10:83-6.

Source of Support: Nil, **Conflict of Interest:** None declared.