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Spina Bifida: A New Taxonomy of Spinal Dysraphism

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ABSTRACT

This paper was proposed to address a huge gap in the medical field. The classification of Spinal Dysraphism is extremely needed which will affect the diagnosis, treatment, and communication in medical practice. Having a terrible classification system makes confusion, hard to remember, confuses spine birth defects together, and not practical. Therefore, this paper will have a new taxonomy for spina bifida which will be easy, simple, inclusive for different types of spine defects, and easy to distinguish between each subtype.

Keywords: Spina Bifida, Taxonomy, Spine Defects, Spinal Dysraphism, Neurology.

INTRODUCTION

Spina Bifida is Latin for split spine which is a birth defect occurs due to failure formation of spinous process and laminae which could lead to spinal cord or meninges displacement and forming of sinus sometimes see Figure 1.

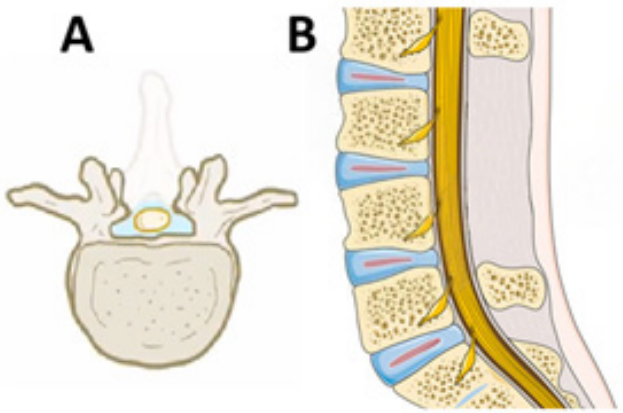

Figure 1. Two section, one axial (A) shows spinous process defect and one coronal (B) of the spine illustrating absence of dorsal compartment of vertebrae which allow formation of spina bifida.

Spina Bifida was re-classified due to it's difficult nature. The present classification system is very confusing and not practical see chart 1. It does not use terms close to the spinal defect and sometimes two terms will be used side by side and they contradict each other. For example, some

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spine defects are called spina bifida occulta/aperta. How is it possible to be closed and open in the same time? Some uses the contents of the spina bifida like lipomyelomeningocele meaning lipoma, nerve, meninges forming a cyst. They classify it under spina bifida occulta! These examples show the weakness of the current classification system which needs to be re-classified in rational, simple, and non-confusing sense. The result of doing this taxonomy is providing easy to remember, realistic, and defects inclusive terms that are easy to be distinguished from each other by medical experts and students.

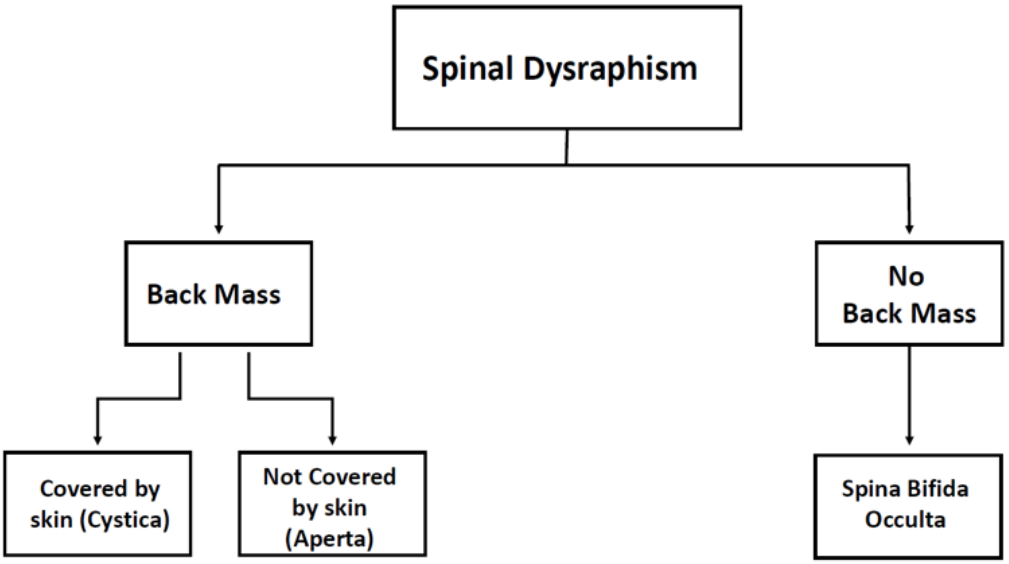

Chart 1. The current classification of Spina Bifida.

There could be a spina bifida with back mass, but it is mainly lipoma and it does not contain any cyst or any other structure that is classified under a certain spina bifida subtype. The current classification classifies each subtype as seen in charts 2, 3, and 4.

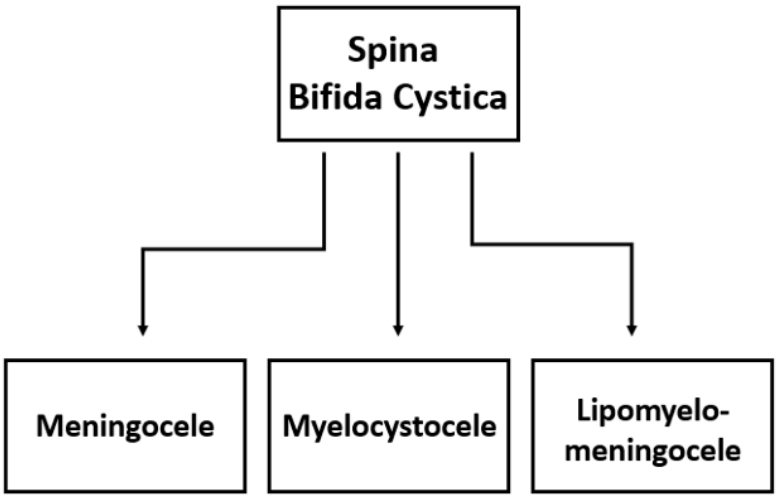

Chart 2. Spina bifida cystica according to the current system.

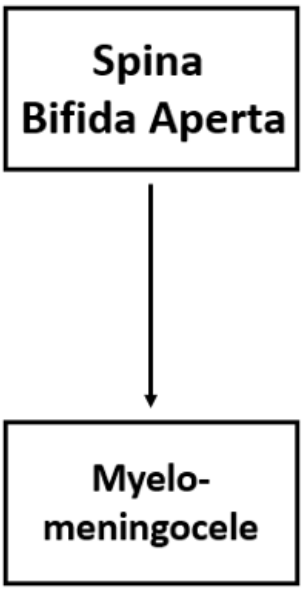

Chart 3. Spina bifida aperta according to the current system.

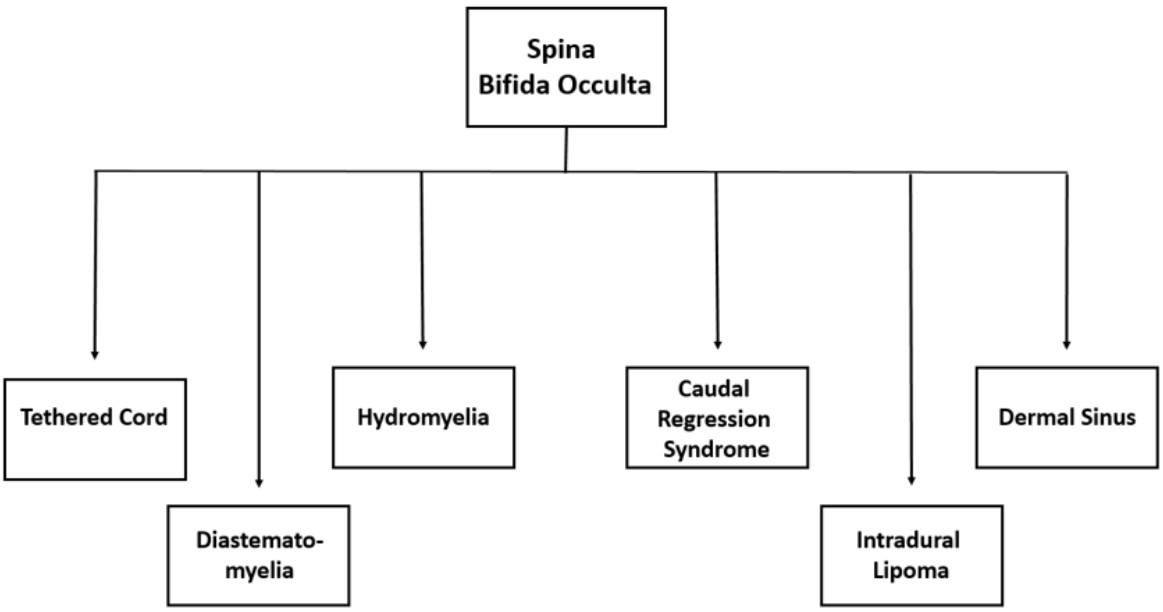

Chart 4. Spina bifida occulta according to the current system.

Spina Bifida New Taxonomy

The classification system highlighted above is arbitrary, confusing, and overlapping each other. In order to resolve this overlapping, a new system that focuses on the "primary" morphological classification of the spinal dysraphism.

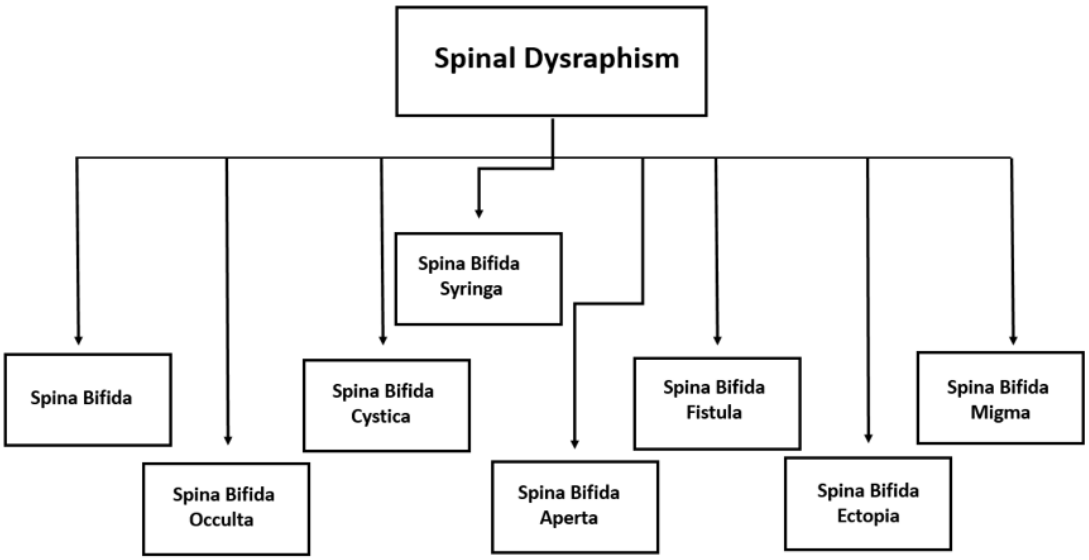

Chart 5. The proposed Spina Bifida taxonomy.

Spina bifida (spinal lipoma)

Spina bifida, simple spina bifida, or congenital spina bifida lipoma is a condition that present from birth with a simple spinal lipoma appears like a lump in or behind the spine (i.e. intradural or extradural) see figure 2 and 3.

Figure 2. Spina Bifida Lipoma.

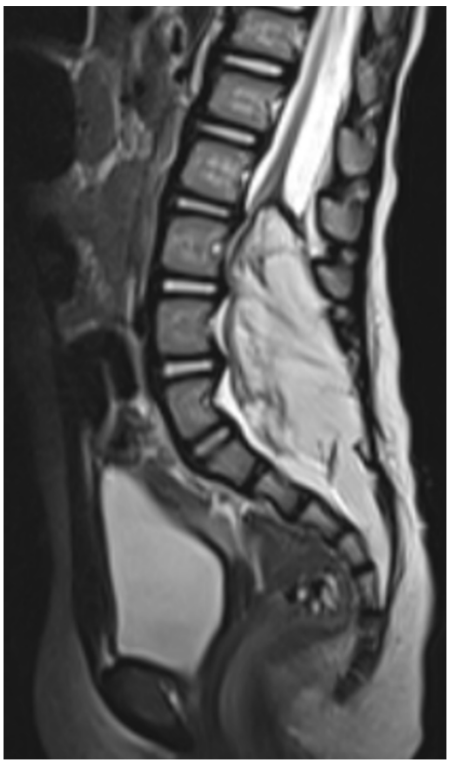

Figure 3. A sagittal MRI T1 shows a spinal lipoma.

Spina Bifida Occulta (hairy bifida)

The spina bifida occulta is hidden spina bifida which could be lipomyelomeningocele, tethered cord, tight filum syndrome, or diastematomyelia see Figure 4 and 5.

Figure 4. Spina Bifida Occulta.

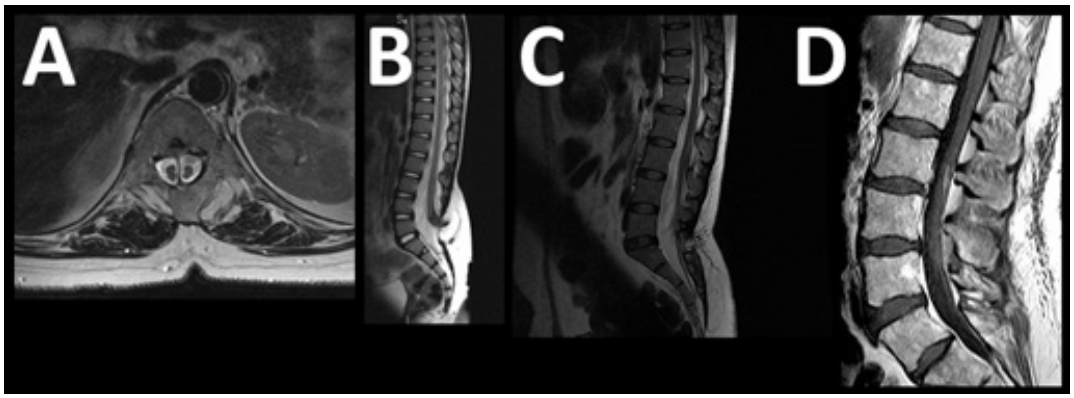

Figure 5. MRI sections shows diastematomyelia in (A), lipomyelomeningocele in (B), tethered cord in (C), tight filum syndrome in (D).

Spina Bifida Cystica (meningocele)

This subtype of spinal dysraphism cystic in nature which could be meningocele, myelomeningocele, myelocystocele, or lipomeningocele see figure 6 and 7.

Figure 6. Spina Bifida Cystica.

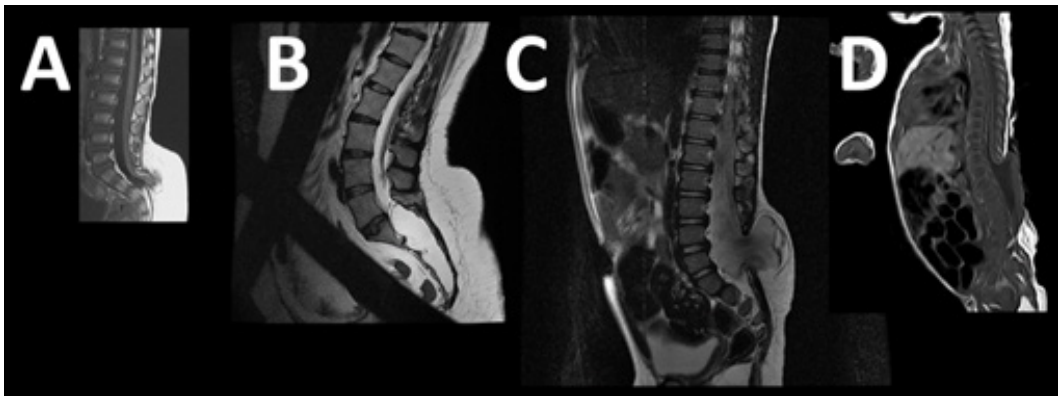

Figure 7. MRI sections show lipomeningocele, meningocele, myelomeningocele, or myelocystocele respectively.

Spina Bifida Aperta (myelocele a.k.a myeloschisis)

Spinal cord passes to reach the outer surface and the spinal cord is exposed to the outside environment. This could be myelocele and myeloschisis see figure 8 and 9.

Figure 8. Spina Bifida Aperta.

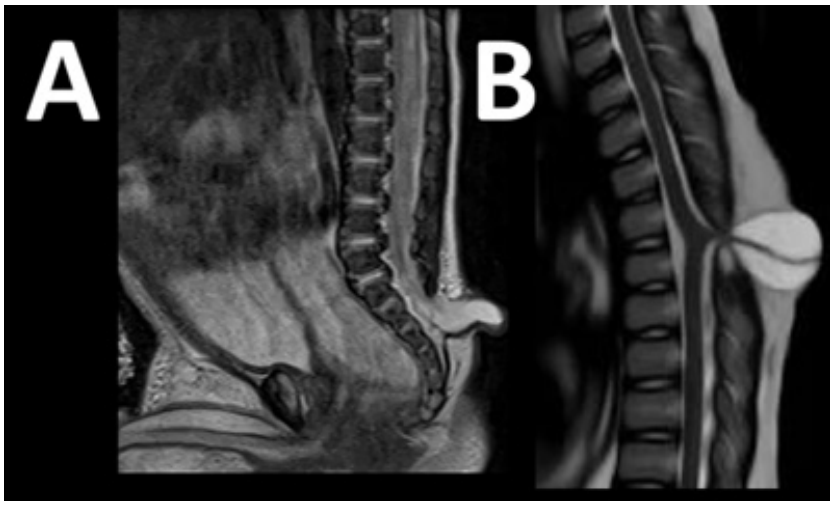

Figure 9. MRI sections show myelocele (A) and myeloschisis (B).

Spina Bifida Fistula (dermal sinus)

This subtype of spinal dysraphism is characterize by having a dermal sinus tract connecting the spinal canal to the external side see figure 10 and 11.

Figure 10. Spina Bifida Fistula.

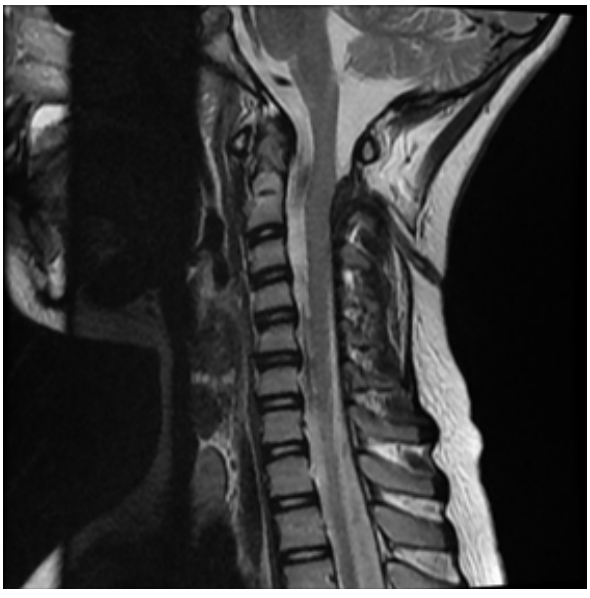

Figure 11. MRI section shows dermal sinus tract.

Spina Bifida Ectopia (meningomyelocele)

This subtype of spinal dysraphism is characterize by having an ectopic spine protruding outside the vertebral column like in cases of myelocystocele see figure 12 and 13.

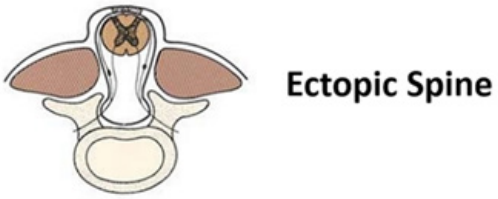

Figure 12. Spina Bifida Ectopia.

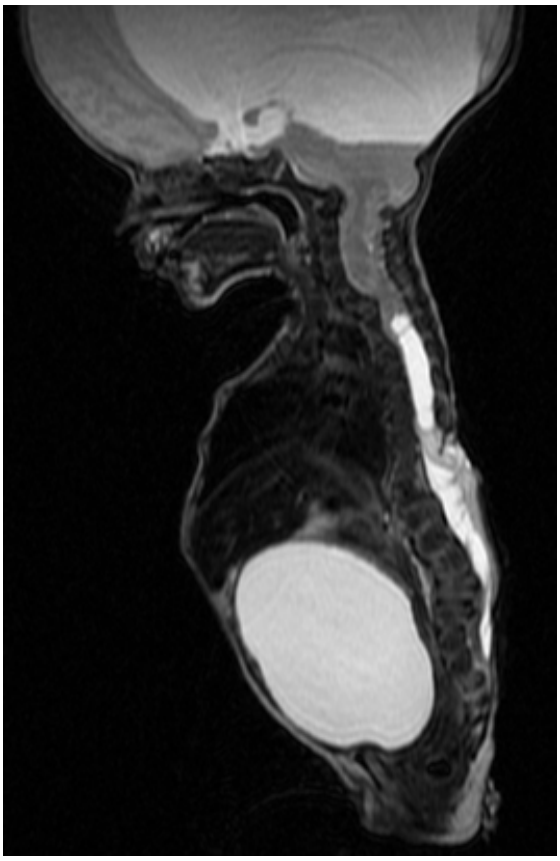

Figure 13. MRI section shows ectopic spine meningomyelocele.

Spina Bifida Syringa (syrinx)

In this subtype, the classification system ignores whether the spine is ectopic or not since the spine is not ectopic in the length of the spinal cord in it's entirety. Therefore, the focus is on the syrinx, not the ectopia. If the spine has syrinx and it is ectopic in it's entirity, then this type is classified as mixed in nature which will be highlighted in the next type see figure 14 and 15.

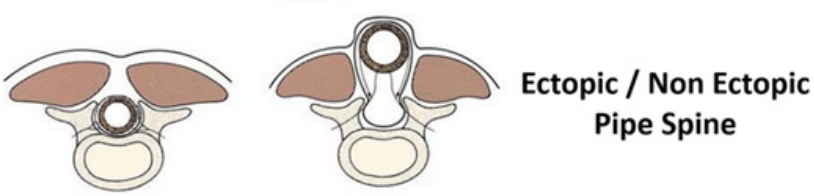

Figure 14. Spina Bifida Syringa.

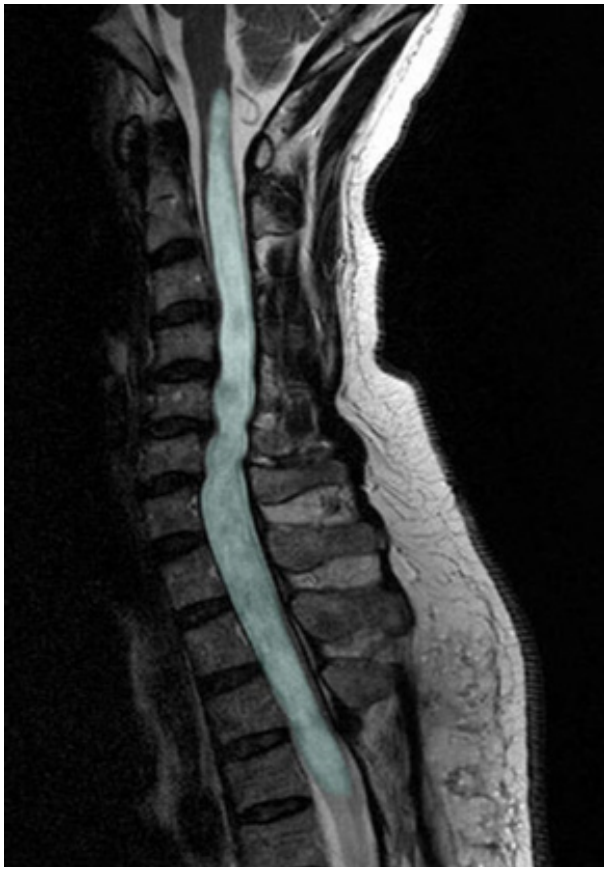

Figure 15. MRI section shows syringomyelia.

Spina Bifida Migma (spine with two or more of the previous defect types)

Migma is Greek means mix or mixture. In this subtype of spinal dysraphism, the spine is affected with two or more of all the previous types. For example, the spine might have lipoma, myeloschisis, and dermal sinus tract then this case is classified as spina bifida magma see figure 16 and 17.

Figure 16. Spina Bifida Migma.

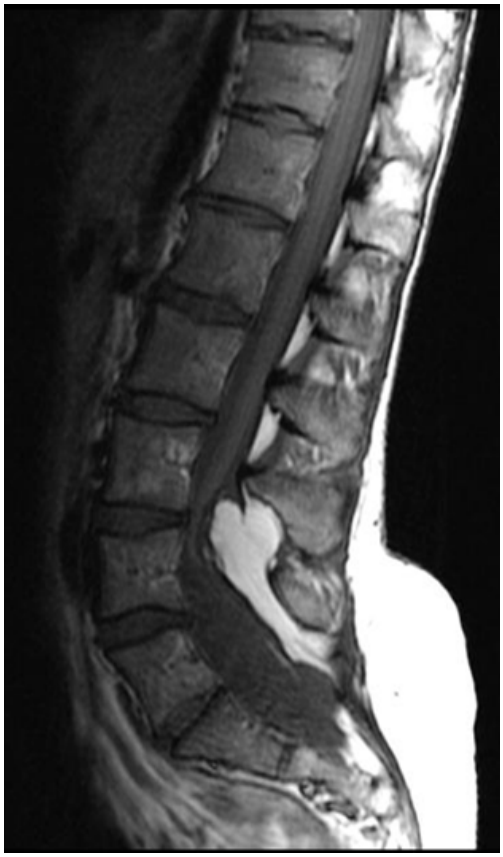

Figure 17. MRI section shows lipomyelocele and tethered cord (i.e. Spina Bifida Migma).

Types of Spinal Dysraphism and Subtype of Each Category

Types	Subtypes
Spina Bifida	Spine lipoma, Intradural spinal lipoma, spine lump with posterior arch defect, intradural extramedullary lipoma at the conus, filum terminale lipoma.
Spina Bifida Occulta	Lipomyelomeningocele, tethered cord, tight filum syndrome, and diastematomyelia.
Spina Bifida Cystica	Meningocele, myelomeningocele, myelocystocele, and lipomeningocele.
Spina Bifida Aperta	Myelocele, myeloschisis.
Spina Bifida Fistula	Dermal sinus tract.
Spina Bifida Ectopia	Myelocystocele.
Spina Bifida Syringa	Syringomyelia, syringomyelocele, hydromyelia, ventriculus terminalis of the conus medullaris, or any spinal syrinx.
Spina Bifida Migma	-Two at least from the above mentioned conditions. -Grave defect that do not fit any category due it's severity. Since it cannot be recognized under any type of spina bifida like: caudal regression syndrome, split notochord syndrome, etc. -Bony changes like: butterfly, hemi-vertebrae, fused, and sacral agenesis. (caudal regression syndrome).

DISCUSSION

The old system was proposed by many authors based on embryological bases [1-3]. Lipomyelomeningocele for example presents sometimes as closed dysraphism with a mass which contradicts the core classification of occulta in the previous system. Now in this new system, if there is an occulta with a mass it will be automatically considered spina bifida migma since it has two types mixed together. There are many authors who oppose the current system for being misaligned with surgical and clinical findings [4-9]. Many authors tried to fix the classification system, but they did not provide any new acceptable taxonomy [1,3,4,7].

CONCLUSION

This new taxonomy of spina bifida and spinal dysraphism is unique, new, and practical. It allows all clinical and surgical findings to fit under a specific type of the subtypes easily. This classification system is easy to remember and it focus on the congenital anomaly morphology in the first place.

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