

## **Ultrasound spinal cord of newborn and infants: normal radioanatomy and variant of normal.**

**Poster No.:** C-1245  
**Congress:** ECR 2018  
**Type:** Educational Exhibit  
**Authors:** B. Bannar<sup>1</sup>, D. BASRAOUI<sup>2</sup>, H. Jalal<sup>2</sup>; <sup>1</sup>MARRAKECH/MA, <sup>2</sup>Marrakesh/MA  
**Keywords:** Neuroradiology spine, Ultrasound, Education, Education and training  
**DOI:** 10.1594/ecr2018/C-1245

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method ist strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

[www.myESR.org](http://www.myESR.org)

## Learning objectives

- To know the indications of spinal ultrasound. When to realize it?
- To describe the technique of spinal ultrasound.
- To perform the normal radio anatomy and the variants of the normal.
- To identify the elements of the report.

# Background

- Spinal ultrasound is the best examination, inexpensive, non-irradiating screening for these spinal abnormalities mostly dysraphism
- It allows to analyze the osteocartilaginous walls of the medullary canal and its contents: spinal cord, roots, cerebrospinal fluid (CSF)

## **Anatomical reminder:**

- The spinal cord is located in the vertebral canal.
- It extends from the occipital foramen to the 1st or 2nd lumbar vertebrae.
- A small fibrous filament, derived from the meninges: terminale filum  
extends from the end of the spinal cord to the coccyx.
- The spinal cord has 2 fusiform swellings:
  - Cervical enlargement : C4-D1 (brachial plexus)
  - Lumbar enlargement : D10-L1 (lumbosacral plexus)
- It is maintained in a relatively fixed position in the meninges by fibrous bridges (serrated ligaments).
- 31 pairs of spinal nerves leave the spinal cord and exit the vertebral canal through foramen.

# Findings and procedure details

## Technique of spinal ultrasound

- Spinal cord is easily analysable until 3rd month
- Through the posterior arches incompletely ossified.
- Infant in prone, with pillow under the abdomen or lateral decubitus.
- Linear probe of high frequency (at least 7 MHz) with axial and longitudinal cuts from the occiput to the sacrum.
- Analysis of the bulbo-medullary junction: flexion of the neck or phased-array that follows the physiological cervical lordosis of the infant.

## Indications

### 1. *Clinical lumbosacral anomaly :*

#### Cutaneous stigma at high risk of dysraphism:

- Angioma on the midline, nevus.
- Subcutaneous mass.
- Tuft of hair or a pigmented spot.
- Caudal appendix.
  
- Aplasia or cutaneous hypoplasia.
- Dermal sinus.
- Sacral agenesis.
- High-risk coccygeal fossa: atypical fossa, > 5 mm in size and more than 2.5 cm from the anus.

#### Cutaneous stigma at high risk of dysraphism:

- Simple coccygeal fossa, <5 mm and <2.5 cm from the anal margin.
- Or bony: hemi vertebrae, dehiscence of the posterior arch.

### 2. Anorectal malformation

3. Fight Bladder, unexplained bladder globe , or repetitive urinary tract infections.

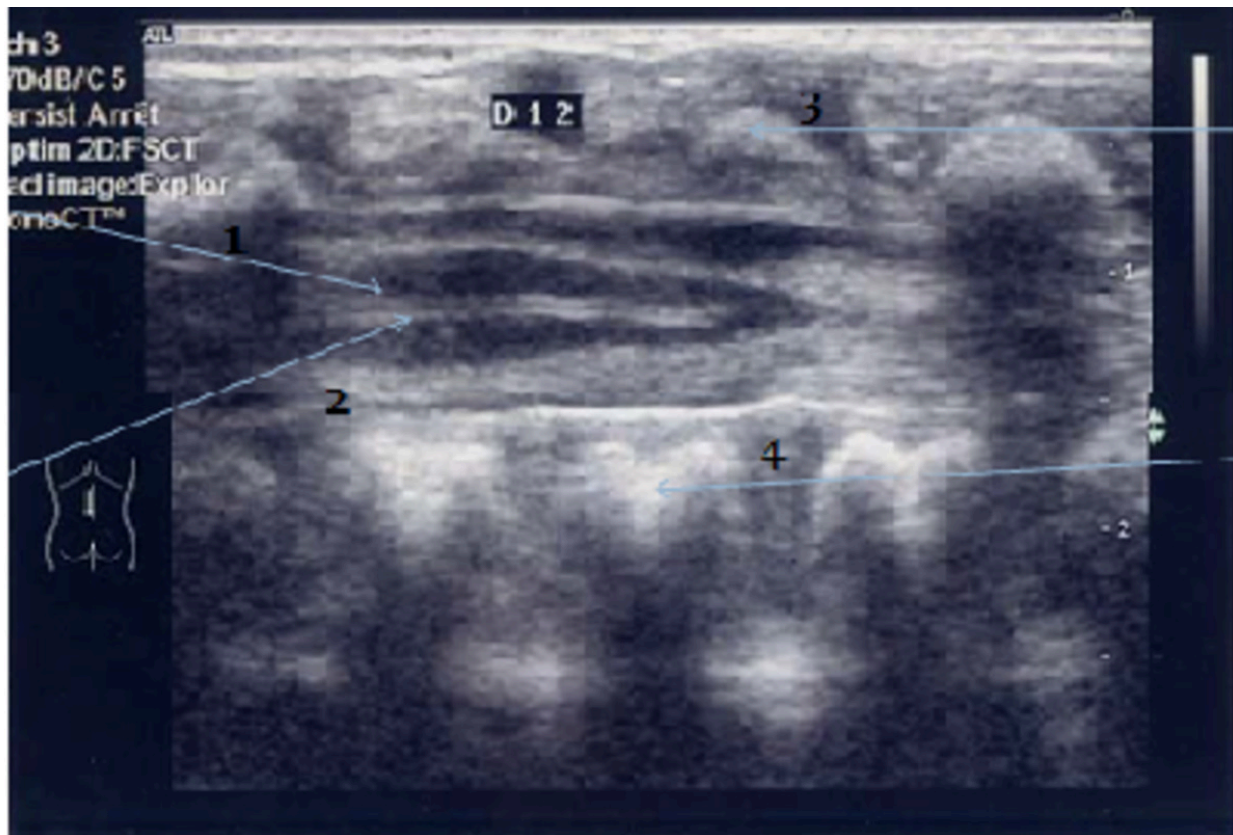
4. Abnormal neurological examination of the lower limbs.

**A normal spinal ultrasound eliminates severe dysraphism and provides an MRI.**

**Normal radio anatomy of spinal ultrasound :**

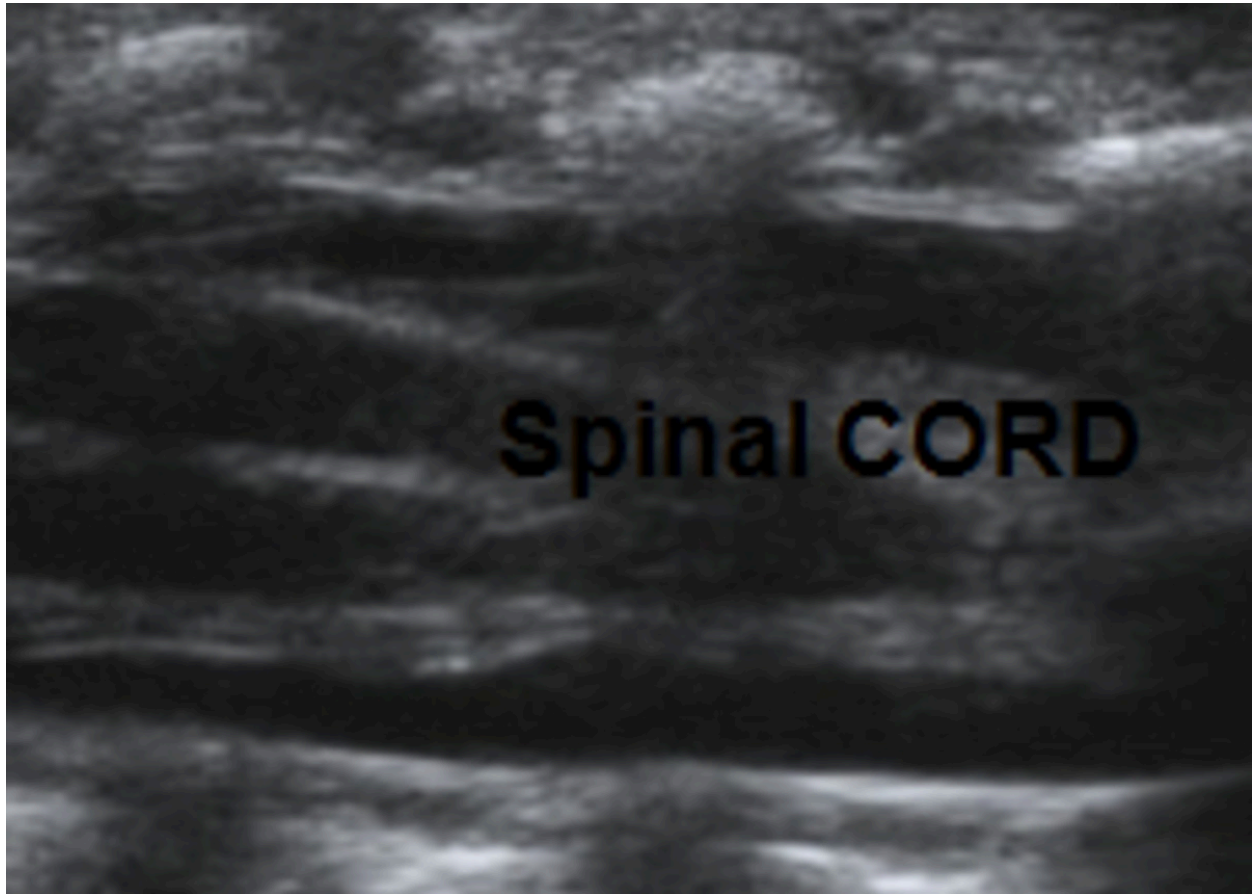
1) The spinal cord:

- Marrow: hypoechoic tubular structure, thicker in the cone region (about 5.5 mm) thinner in the dorsal region (about 4.5 mm).
- Centered by a hyperechoic echo"complex central echo" : at the acoustic interface between the anterior white commissure and the central part of the anterior median fissure.
- Laterally, the marrow is fixed by the serrated ligaments (arachnoidal duplications) which appear as fine linear echoes oriented transversely.



**Fig. 1:** 1 Spinal cord 2 Central canal of the spinal cord 3 Spinous process 4 Body of vertebrae

**References:** - MARRAKECH/MA



**Fig. 5:** normal spinal cord

**References:** - MARRAKECH/MA

2) The cervico-occipital hinge

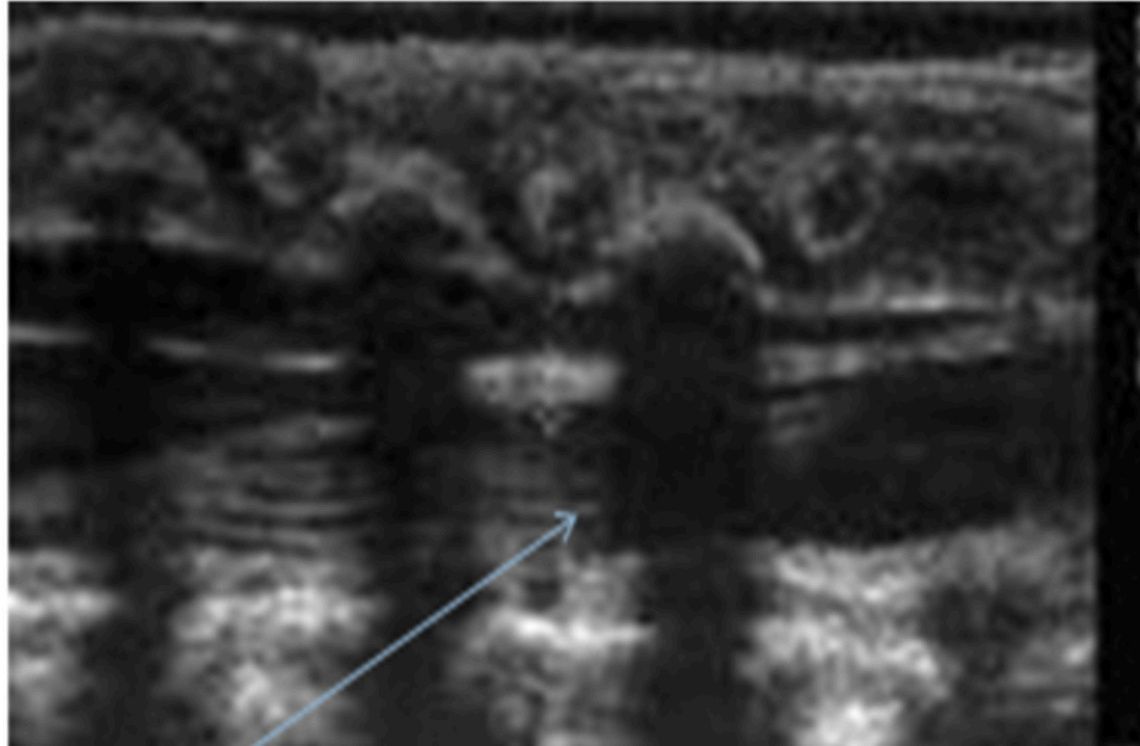
Sub-occipital sagittal section:

- Large cistern
- Cerebellar tonsils to eliminate a chiari malformation.
- Analyze the pons, bulb and cervical spine
- Within the subarachnoid spaces

3) terminal conus medullaris :

- Conus medullaris : ends above L3.  
Its terminal portion gradually tapered continues with the terminal filum whose thickness varies from 0.5 to 2 mm.

- Filum terminale visualized on the median line, behind the roots. Its thickness is = or less than 2 mm.



**Fig. 2:** filum terminale

**References:** - MARRAKECH/MA



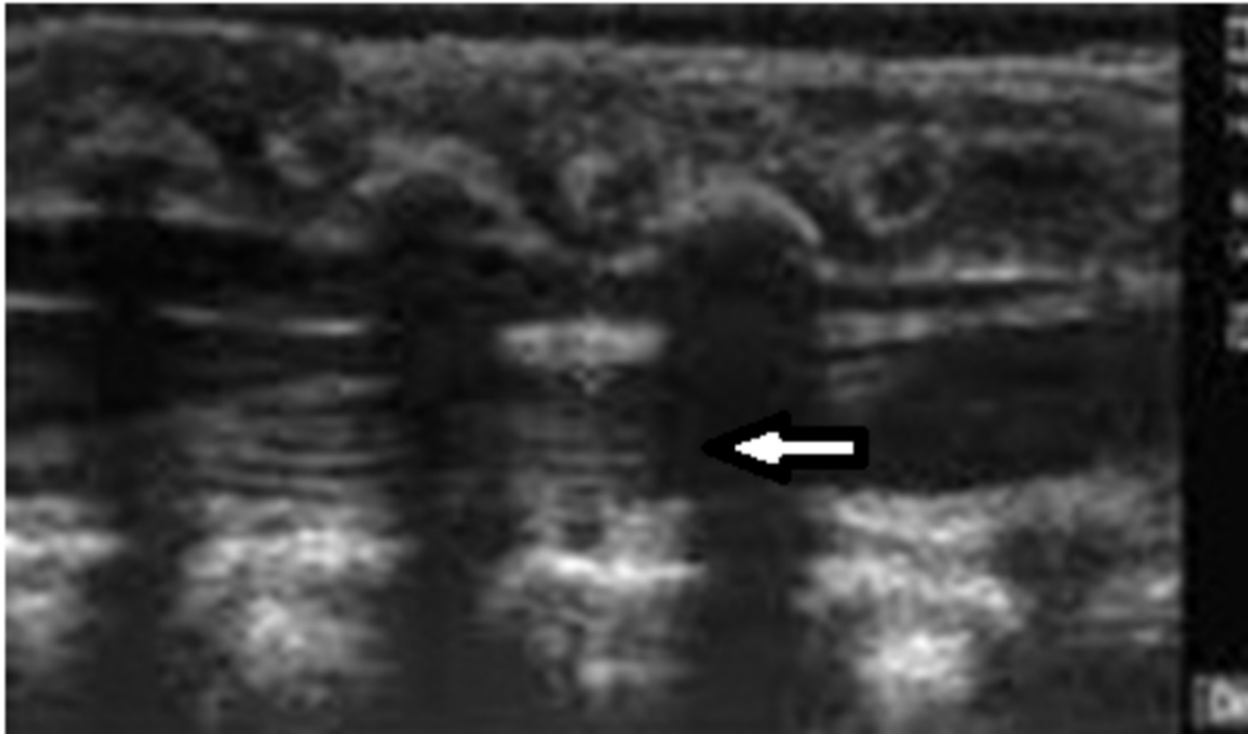
**Fig. 4:** filum terminale

**References:** - MARRAKECH/MA

- Lumbar and sacral roots (ponytail): echoic features, arranged around and below the terminal cone.

- The ending of the space dural is in S2.





**Fig. 3:** Lumbar and sacral roots

**References:** - MARRAKECH/MA

**Simple clinical and ultrasound landmarks to identify vertebral bodies, and locate the terminal cone:**

**Clinical landmarks :**

- The tip of the last rib is L2.
- The top of the iliac crest corresponds to L4.

**Ultrasound landmarks :**

- Follow the 12th coast until T12
- Visualization of the renal pedicle located at L2
- Possibly identifying the 1st sacral vertebra (in the absence of transitional anomaly).

**The variants of the normal:**

In about 10% of newborns.

1)The dilation of the terminal ventricle (rare):

- Anechoic formation,
- Ovoid v Clear limit
- Hyperechoic in the filum or in the conus medullaris
- Size <5mm
- Stability over time

## 2) Filum Terminale cyst:

- Origin discussed
- Arachnoid reflexion or embryonic remnant covered with ependymocytes.
- Less visible on MRI
- Strict criteria:

- Median line
- In the filum, just below the spinal cone
- Fusiform
- Well limited
- Anechoic as a simple cyst.

## 3) Transient dilatation of terminal ependymal canal:

Differential diagnosis of syringomyelia and terminal ventricle.

## 4) Pseudo dermal sinus

- Fibrous tissue extended: cutaneous dimple → coccyx.
- Dermal sinus is rarely located at the tip of the coccyx and often more cranial.
- Search mass or liquid well along this fibrous tract.

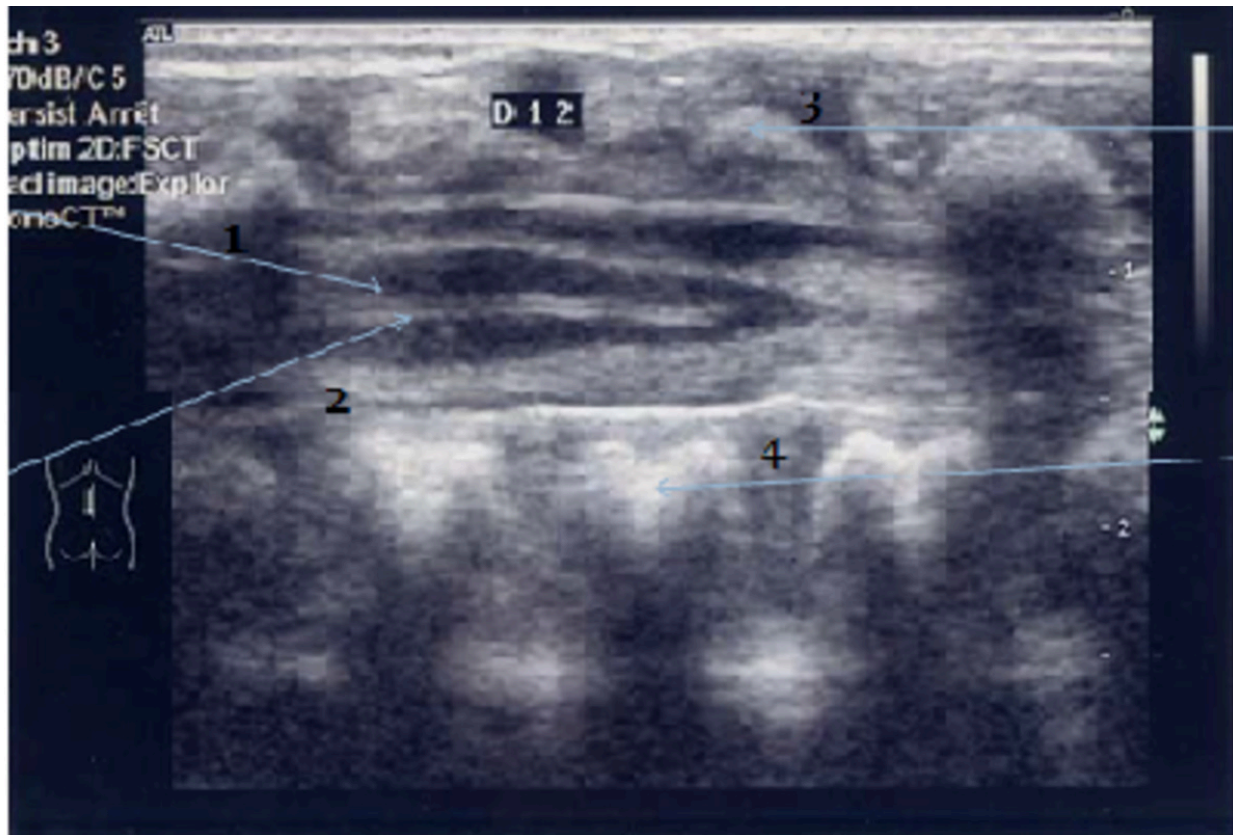
## 5) Filum prominent

- More visible compared to nerve roots.
- Thickness > 1mm
- median

## 6) Coccyx:

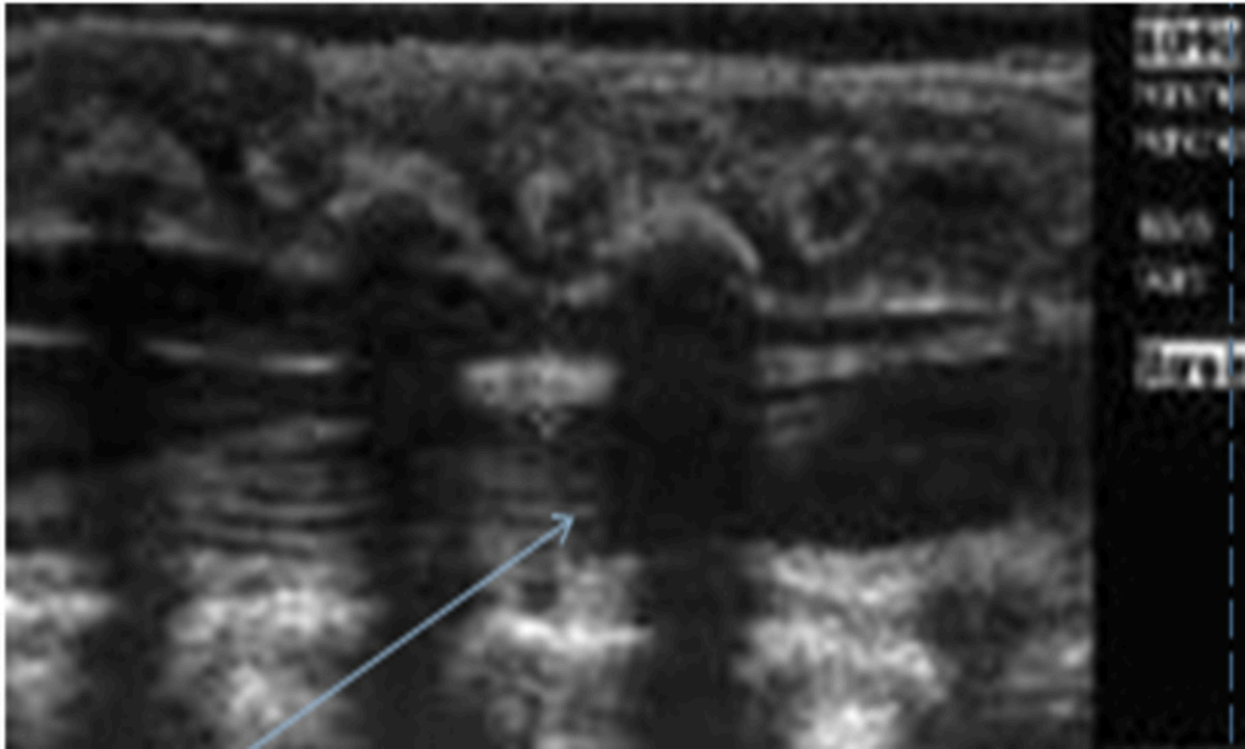
- Many possible variations can be considered as a mass on palpation.

Images for this section:



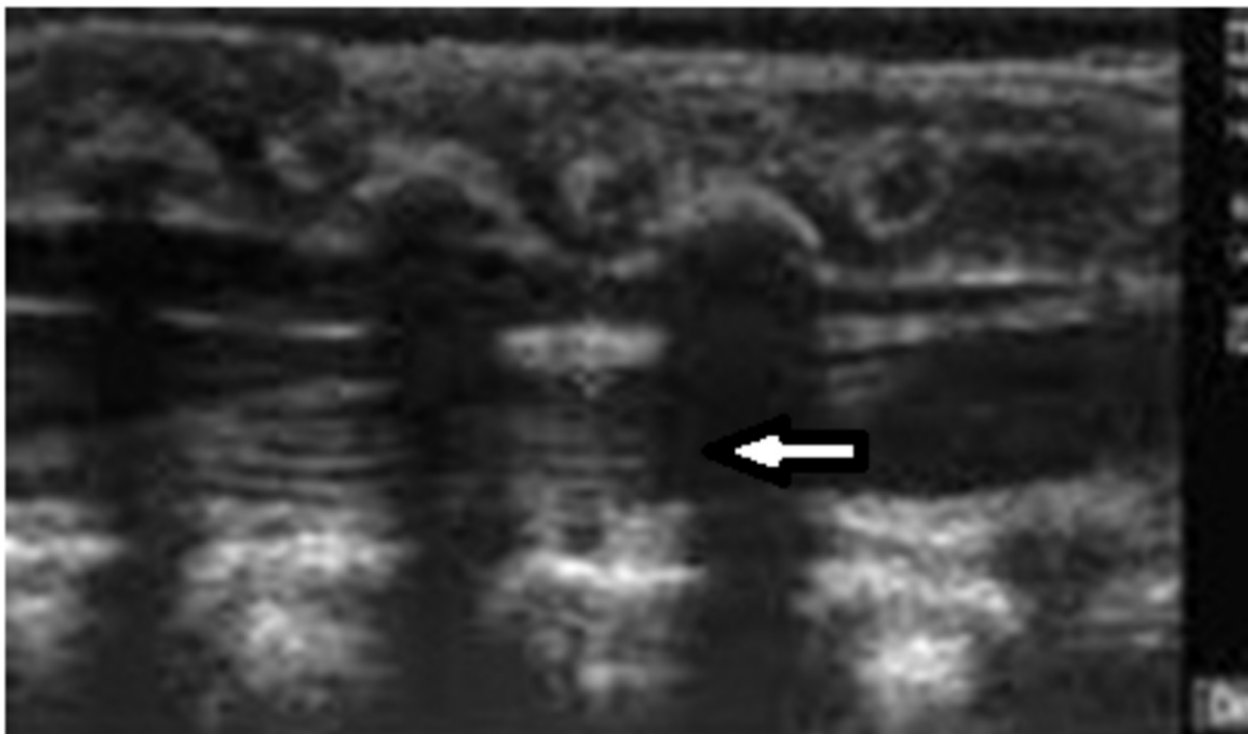
**Fig. 1:** 1 Spinal cord 2 Central canal of the spinal cord 3 Spinous process 4 Body of vertebrae

© - MARRAKECH/MA



**Fig. 2:** filum terminale

© - MARRAKECH/MA



**Fig. 3:** Lumbar and sacral roots



# Conclusion

**Spinal ultrasound is the best examination in the search for spinal malformations in newborns and infants.**

Normality criteria:

- A conus medullaris in place, above L3.
- A filum terminale , equal to or less than 2 mm.
- Movable lumbar and sacral roots.
- Absence of echogenic mass of dural space.

Any abnormal spinal ultrasound should be

- complemented by an ETF.
- MRI explores the totality of the spinal cord and these envelopes in the different planes of space.

## **Personal information**

### **Dr. Badiaa Bannar**

Department of Radiology, Hospital mother and child CHU Mohamed VI MARRAKECH MOROCCO.

Email: bannarbadiaa@gmail.com

number phone: +21215084778

### **Dr. Dounia Basraoui**

Department of Radiology, Hospital mother and child CHU Mohamed VI MARRAKECH MOROCCO.

Email:douniabasaroui@gmail.com

### **Dr. Hicham Jalal**

Department of Radiology, Hospital mother and child CHU Mohamed VI MARRAKECH MOROCCO.

Email;jhicham2000@hotmail.com

## References

1. Echographie de moelle anté et post natale, J.BIGOT
2. Échographie médullaire:C Guilley, , D Sirinelli, J Maheut-Lourmière CHU Tours, 2002
3. Apport de l'imagerie dans les malformations vertébro-médullaires:  
K .TALBY ; M.BOUBOU ; F. GHADOUANI ; N. SQALLI ; S. TIZNITI, SERVICE DE RADIOLOGIE CHU HASSAN II FES
4. Apport de l'IRM dans les dysraphismes : à propos de 54 cas  
H. Moumou, L. Chat, N. Allali, R. Dafiri, M. Chellaoui  
Service de radiologie, Hôpital d'enfants, Rabat-Maroc
5. ECHOGRAPHIE MEDULLAIRE, B.Bourlière-Najean 1999
6. Séméiologie échographique des dysraphies médullaires, Journée du CPDP d'Alsace, 5 octobre 2012, Anne Sophie Weingertne
7. L'échographie de la colonne lombaire chez l'enfant, LeSaux Cathy, TRM, Septembre 2002