

Scientific Paper

## **B-330 Cervical lymph node ultrasonography in HIV infected children**

**A. Butnaru** (Cluj Napoca/RO)

**S. D. Bolboaca** (Cluj Napoca/RO)

**C. Botar-Jid** (Cluj-Napoca/RO)

**C. Marcu** (Cluj Napoca/RO)

**C. Itu** (Cluj Napoca/RO)

**P. Florescu** (Cluj Napoca/RO)

**Topic:** Pediatric

## Purpose

Using gray scale, color and power Doppler ultrasound methods, is possible to evaluate the lymph nodes structure and vascularisations.

The role of gray scale and power Doppler sonography in evaluation of neck lymph nodes is well established [1, 2, 3]. Using ultrasound, signs of benignity and malignancy can be differentiated. The presence or absence of an echogenic hilus (gray scale sonography) within a node cannot be taken as the sole deciding factor of whether a node is benign or malignant, but generally its presence was considered as a sign of benignity [4]. The patterns of vascular hilar distribution or avascularity are present generally in benign or normal lymph nodes (power Doppler sonography). The lymph nodes are the main localization for HIV virus. Lymphadenopathy is frequent in persons with HIV infection (HIV-related lymphadenopathy, opportunistic infectious agents and neoplasms) occurring either as one of the earliest manifestations of infection or as a finding at any time throughout the clinical course of progression through AIDS. The histopathological patterns of HIV-related lymphadenopathy, follow the decline in CD4 lymphocytes: follicular hyperplasia without follicular fragmentation; follicular hyperplasia with follicular fragmentation; follicular involution, and follicular depletion. These patterns follow in the above sequence and they are present in lymph nodes throughout the body (with the exception of follicular hyperplasia with follicular fragmentation), regardless of the presence or absence of gross lymph node enlargement [5]. The HIV-related lymphadenopathy ultrasound finding are the expression of histopathological changes and corresponds also with the decline in CD4 lymphocytes.

We investigated the potential of cervical lymph nodes ultrasound examination, to estimate the group of CD4 lymphocyte level ( $>500/\text{mm}^3$ ,  $500-200/\text{mm}^3$ ,  $<200/\text{mm}^3$ ) in HIV infected children. We were expected to demonstrate the lymph nodes ultrasound value in orientating the therapy.

## Methods and Materials

Forty HIV positive children, stage B and C, mean age 11.15 (range 7 to 15 years), 21 female were prospectively investigated by ultrasound cervical lymph nodes examination, for a period of 3 years. Every patient was examined at least twice during the evolution of infection. Ultrasound findings were correlated with clinical examinations and CD4 lymphocytes count. We excluded the cases with opportunistic infections or associated neoplastic disease at the time of examination. In every patient, the submandibular, parotid, upper internal jugular vein, and superficial latero-cervical lymph nodes groups were studied on both sides using longitudinal and transvers ultrasound sections. High-resolution 7.5 to 10 MHz linear transducer with color and power Doppler (Medison SONOACE 8800) was used. The number and shape of the lymph nodes, the maximum diameter, the ratio of the longitudinal (maximum) diameter to the transverse (minimum) diameter (L/T ratio), the presence or absence of hilum echogenicity, the presence or the absence of intranodal vasculature, type of blood distribution and nature of the blood vessels (arterial or venous) were studied. According to stages of HIV-infection, there were: 11 cases in B1 stage, 4 cases in B2 stage, 5 cases in B3 stage, one case in C1 stage, 10 cases in C2 stage and 9 cases in C3 stage.

## Results

In 40 treated HIV positive children, were found a total number of 696 lymph nodes, with a predominantly ellipsoid shape, sharp margins, absence of an echogenic hilus and hypoechogenicity compared with adjacent muscle. The L/T ratio between the longitudinal and the transverse diameter were greater than 1.5 (88%). In 63% of cases, the nodes were hypoechoic, with a homogeneously echostructure. The maximum diameters were greater than 10 mm in 71.6% cases, and below 10 mm in 28.4% of cases.

There were found in 49.1% of cases a prominent hilar vascular pattern. 41.5 % of cases were found a diminished hilar vascular pattern and in 9.4 % there were found no vascular signal. The distributions of lymphadenopathy were: 58% in lateral cervical group, 15% in parotid lymph nodes, 14% in submandibular group and 13% in internal jugular vein group. The sizes of cervical lymph nodes depend on the lymph nodes group and the largest observed were the parotid and submandibular lymphadenopathy.

Considering all these elements, we were concluded that in the HIV lymphadenopathy there is a particular ultrasound pattern, with benign (ellipsoid shape, hyperechoic hilus, unique vascular pole) and malignant elements (homogeneously hypoechoic, diameter greater than 10 mm). We have identified three ultrasound types which we have classified in:

- type I A: hypoechoic, with prominent hilar blood flow (**Figure 1<sup>\*1</sup>, 2<sup>\*2</sup>**)
- type I B: hyperechoic center, frequently of small dimensions and prominent hilar vascular pattern (**Figure 3<sup>\*3</sup>, 4<sup>\*4</sup>**)
- type II A: hypoechoic, with diminished vascular hilar pattern (**Figure 5<sup>\*5</sup>, 6<sup>\*6</sup>**)
- type II B: hilar echogenicity and diminished vascular pole (**Figure 7<sup>\*7</sup>, 8<sup>\*8</sup>**)
- type III: homogeneously hypoechoic, with no detectable color and power Doppler blood flow (**Figure 9<sup>\*9</sup>, 10<sup>\*10</sup>**).

All patients had simultaneously two or all three ultrasound types of pattern (**Figure 11<sup>\*11</sup>, 13<sup>\*12</sup>**). The predominant type was established considering the total number of lymph nodes with the same appearance (type) in the same patient, and this type was correlated with the CD4 lymphocytes levels. The analysis revealed that predominant type I (A and B) was present in the patients with a CD4 level higher than  $500/\text{mm}^3$  ( $p=0.0050601$ ), type II (A and B) in patients with CD4 level between  $200\text{-}500/\text{mm}^3$  and type III was associated with a level below  $200/\text{mm}^3$ , but were always found together with type II (A and/or B). For stages of infection the number of patients was not equal. The cervical ultrasound HIV-lymphadenopathy patterns according to lymph nodes number and stages of infection are represented in **Figure 14<sup>\*13</sup>** and **Figure 15<sup>\*14</sup>**.

## Discussion

None lymph node was surgically removed because of the invasiveness of the method and because there was no indication or benefit from the procedure.

The homogeneous hypoechogenicity (A) or peripheral marked hypoechogenicity with small echic hilus (B) was associated with follicular hyperplasia and a broad cortex [5]. The prominent hilar vascular pattern was associated with the follicular hyperplasia. These

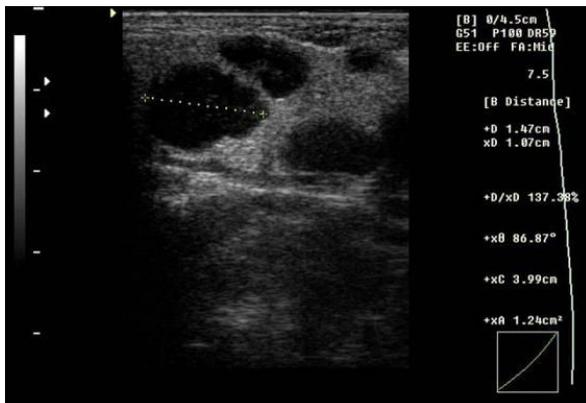
ultrasound aspects resemble to some acute inflammatory lymph nodes.

The diminished hilar vascular pattern was associated with follicular involution and the ultrasound findings resemble with chronic inflammatory lymph nodes. The absence of the blood flow and a diameter smaller than 10 mm was associated with follicular depletion. In children, with CD4 lymphocytes count bellow  $200/\text{mm}^3$ , there were a reduction of the number of the lymph nodes, and they were frequently smaller than 10 mm and with the absence of vascular pattern (type III) associated with type II.

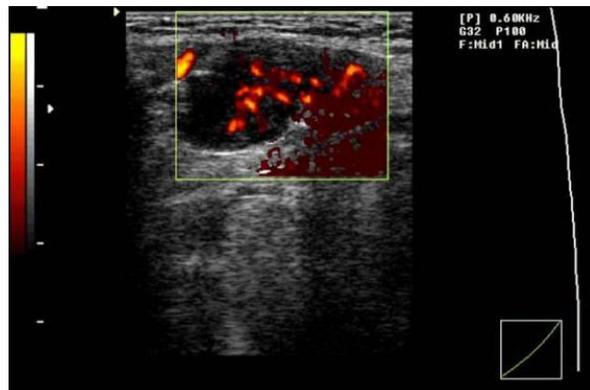
A broad cortex of the lymph nodes, present in follicular hyperplasia, with or without fragmentation, corresponds to a homogeneously hypoechogenicity or to peripheral hypoechogenicity with a faded hyperechoic center.

The involution forms and especially those with follicular depletion are correlated with subsidence of the cortex and a growing of the medulla [5]. These corresponds ultrasonographically to a reduction of the hypoechogenicity and to the disappearance of the echoic center. The lymph nodes became homogeneous, with medium echogenicity, without the presence of power Doppler vascular pattern.

Linked images in Results:



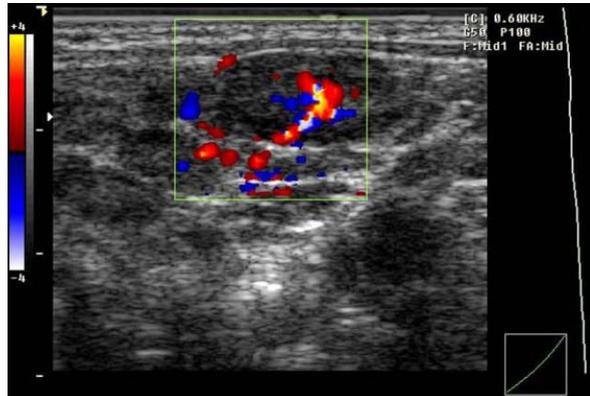
\*1: Figure 1. Gray scale transverse sonogram of the parotid gland, with hypoechoic lymph nodes and absence of an echogenic hilus. (Male patient, 13 years old, B1 stage).



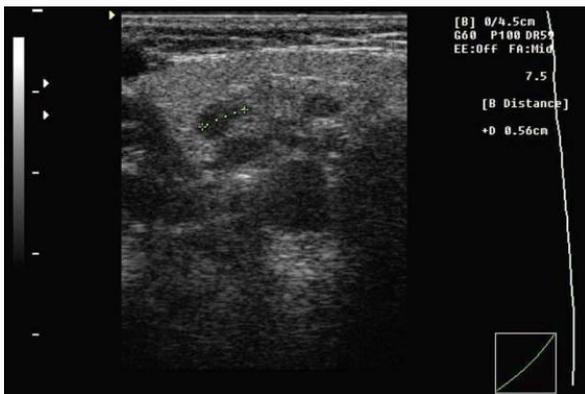
\*2: Figure 2. Power Doppler sonogram of the parotid gland. Hypoechoic lymph node with prominent hilar vascular pattern. (Male, 12 years old, B1stage).



\*3: Figure 3. Gray scale transverse sonogram of the parotid gland. Hypoechoic lymph nodes with presence of an echogenic hilus. (9 years old female, B1 stage infection).



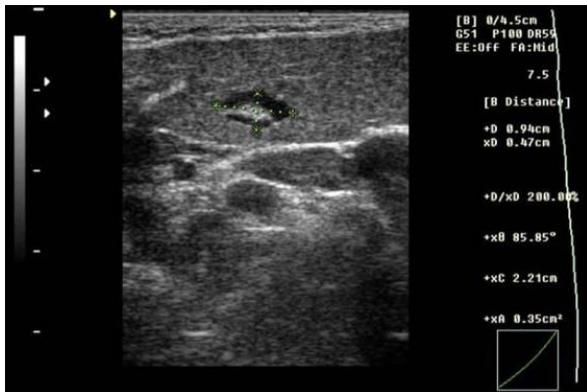
\*4: Figure 4. Doppler Color examination of the same nodes as in Figure 3 showing the presence of hilar vascularity.



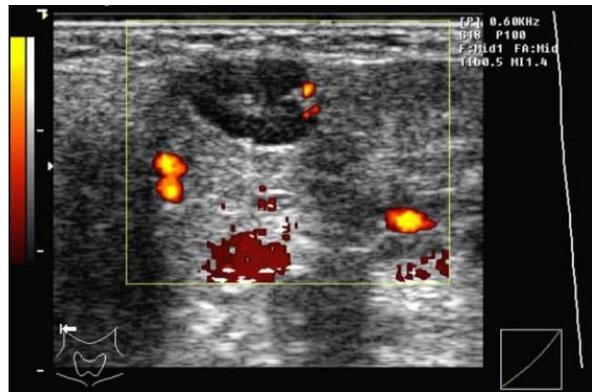
\*5: Figure 5. Gray scale transverse sonogram of the parotid gland. Hypoechoic lymph nodes with absence of an echogenic hilus. (11 years old male, B2 stage).



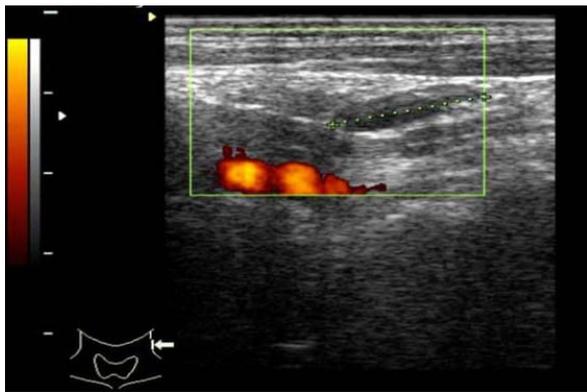
\*6: Figure 6. Color Doppler examination of the same nodes as in Figure 5 showing the presence of diminished hilar vascularity.



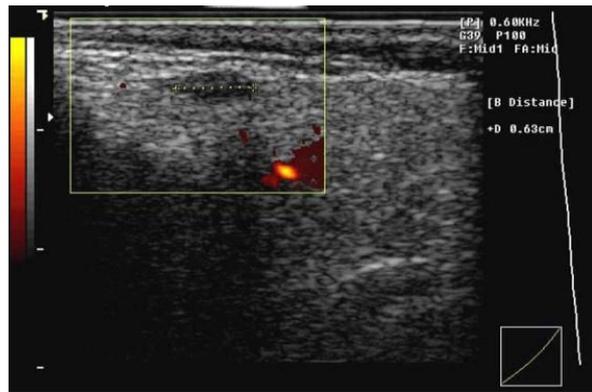
\*7: Figure 7. Gray scale transverse sonogram of the parotid gland. Hypoechoic lymph node with presence of a small echogenic hilus. (13 years old female, B2 stage).



\*8: Figure 8. Power Doppler sonogram of the parotid gland. Hypoechoic lymph node with diminished hilar vascular pattern. (12 years old male, B2 stage).



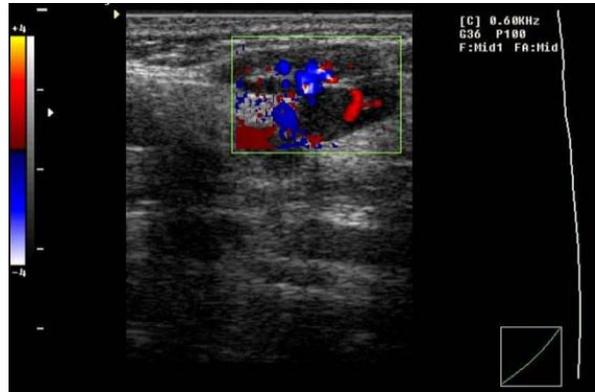
\*9: Figure 9. Power Doppler sonogram of the latero-cervical lymph nodes group. Hypoechoic lymph node with no detectable vascular pattern. (13 years male, C3 stage).



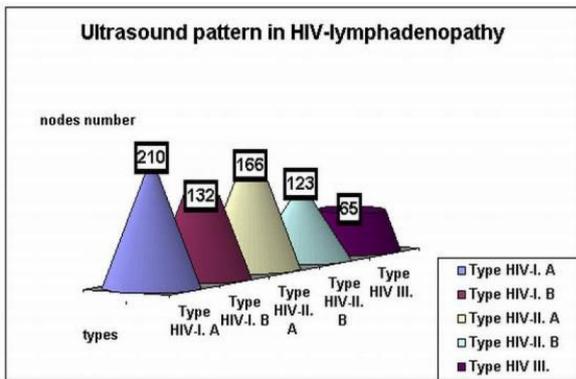
\*10: Figure 10. Power Doppler sonogram of the parotid gland showing a hypoechoic lymph node with no detectable vascular pattern. (10 years female, C3 stage).



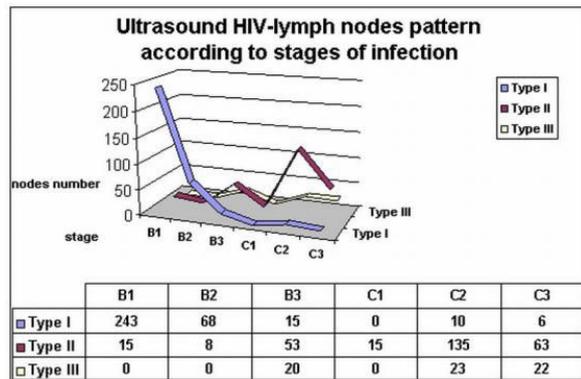
\*11: Figure 11. Power Doppler sonogram of the parotid gland, showing three different types of lymph nodes: I A, II B and III. (12 years old male, C3 stage).



\*12: Figure 13. Color Doppler sonogram of the parotid gland, with types I A and I B lymph nodes pattern. (13 years old male, B1 stage).



\*13: Figure 14. 3-D diagram representing the number of lymph nodes of the three types of ultrasound patterns.



\*14: Figure 15. 3-D diagram representing the ultrasound lymph nodes patterns according to stages of infection.

## **Conclusion**

Ultrasonography is useful examination in the cervical lymph nodes evaluation in HIV infected children. The cervical lymph nodes ultrasound findings in HIV-lymphadenopathy, changes in number, size and type of pattern, with the evolution, CD4 lymphocytes count and antiretroviral therapy reply. Ultrasound examination allows the identification of the predominant lymph node type in HIV- lymphadenopathy and to differentiate the HIV-related lymphadenopathy from lymph nodes opportunistic infectious and neoplasms. Further investigations are indispensable.

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## The Authors

Anca Butnaru<sup>1</sup> MD, PHD (Cluj-Napoca/Ro). Sorana Bolboaca<sup>1</sup> MD (Cluj-Napoca/Ro). Carolina Botar-Jid<sup>2</sup> MD (Cluj-Napoca/Ro). Cristian Marcu<sup>3</sup> MD (Cluj-Napoca/Ro). Corina Itu<sup>3</sup> MD (Cluj-Napoca/Ro). Petre Florescu<sup>1</sup> MD, PHD (Cluj-Napoca/Ro).

<sup>1</sup> "Iuliu Hatieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania

<sup>2</sup> Clinical County Hospital, Cluj-Napoca, Romania

<sup>3</sup> Infectious Disease Hospital, Cluj-Napoca, Romania

## Keywords

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