Middle East Fertility Society Journal xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Middle East Fertility Society Journal

journal homepage: www.sciencedirect.com

Review

Three-dimensional power Doppler ultrasonography in evaluation of adnexal masses

Ahmed M. Abbas [a,*], Amera M. Sheha [b], Mohammed N. Salem [c], Ahmed Altraigey [d]

[a] Department of Obstetrics and Gynecology, Faculty of Medicine, Assiut University, Egypt
[b] Assiut University Hospital, Faculty of Medicine, Assiut University, Egypt
[c] Department of Obstetrics and Gynecology, Faculty of Medicine, Sohag University, Egypt
[d] Department of Obstetrics and Gynecology, Faculty of Medicine, Benha University, Egypt

ARTICLE INFO

Article history:
Received 18 September 2016
Revised 15 March 2017
Accepted 17 March 2017
Available online xxxx

Keywords:
Adnexal masses
Power Doppler
Three-dimensional sonography
Ovarian tumors

ABSTRACT

The differential diagnosis of adnexal masses still represents a challenge in spite of the marvelous efforts that have been made to improve the sonographically based diagnosis. There were rapid technological advances in diagnostic ultrasonography in the last decade, with the recent development of three-dimensional power Doppler ultrasonography (3DPD).

The introduction of 3DPD has opened the possibility to characterize microvasculature of the adnexal masses and objectively assess tumor vascularization. 3DPD allows also an objective measurement of vascularity of a given region of interest by estimating 3 vascular indices (vascularization index [VI], flow index [FI], and vascularization-flow index [VFI]) within such region. The aim of this review article is to evaluate the role of 3DPD in the assessment of adnexal masses vascularity, its ability to discriminate benign masses from malignant ones.

Contents

1. Introduction

Adnexa refer to the anatomical area contiguous to the uterus, and contain the ovaries, fallopian tubes and associated vessels, ligaments, and connective tissue [1]. Adnexal masses are considered to be one of the most common disorders in gynecology. Ovarian tumors, alone; which quantifies for two thirds of these cases, represent an increasing challenge to the sonographers [2].

A preoperative suggestion of malignancy can be a guide for the clinician to refer women with suspicious adnexal masses to a well-trained gynecological oncologist for proper therapy and optimized debulking surgery, which is definitely improve the survival rate [3]. No single diagnostic tool (ultrasonography, magnetic resonance imaging, and computerized tomography) is accurate enough in preoperative diagnosis of malignancy in suspicious cases. However, ultrasound (US) and Doppler waves' analysis remain the chief diagnostic tools for diagnosis of different adnexal masses.

Peer review under responsibility of Middle East Fertility Society.

* Corresponding author at: Department of Obstetrics and Gynecology, Assiut University, Woman's Health Hospital, 71511 Assiut, Egypt.
E-mail address: bmr90@hotmail.com (A.M. Abbas).

http://dx.doi.org/10.1016/j.mefs.2017.03.004
1110-5690/

Recent studies have shown that US (transvaginal plus color Doppler) may differentiate benign from malignant lesions with a sensitivity of 99.1% and a specificity of 85.9% [4].

Appropriate malignancy risk estimation could be achieved by ultrasound assessment of adnexal mass morphology by an experienced sonographer [5]. Doppler ultrasound examination is usually added on grayscale imaging mostly with intention to more correctly predict malignancy. Evaluation of gray-scale ultrasound morphology with color Doppler findings of an ovarian mass by experienced examiner can be highly accurate in predicting the nature of adnexal masses [6].

1.1. Three-dimensional power Doppler ultrasonography

Three dimensional power Doppler ultrasonography (3DPD) is a modern objective method used to evaluate the vascularization of a given tissue volume. The specially designed VOCAL software, used in this technique, can calculate special indices and virtually reconstruct vascular tree within the given tissue volume [7].

This objective non-invasive technique is very promising as it gets over important restrictions of the conventional Doppler US. It has proved to be highly reproducible between sonographers. In addition, it can assess the volume and evaluate the power Doppler signal in the whole target tissue; in contrast to the two dimensional US which can assess the vascularization in only one subjectively chosen two dimensional plane [8].

The 3D color histogram can evaluate vascularization and blood flow within a tissue block through estimation of color percentage and flow amplitude within the volume of interest. A volume probe sweeps through the 3D tissue block to get the 3D information. The border of the volume of interest which contains the color information is delineated automatically through a process called *"shell"*. Measurements that determine neoangiogentic flow should exclude high velocity flow vessels (such as iliac vessels) from the volume of interest. Due to sensitivity of the amplitude-based color Doppler, tissue, patient and probe movement artifacts are quite common. Exclusion of these artifacts is a must [9].

"*Voxels*", analogous to 2D "pixels", are the smallest units of stored volume ultrasound information obtained using 3DPD ultrasonography. The range for values for both gray scale voxels and color scale voxels varies from lowest intensity being 0 and highest intensity being 100 (0–100). The summation of their values equals the total number of voxels [10].

Four indices are calculated automatically by the VOCAL program once the contour of the volume of interest is delineated. These calculated indices include vascularization index (VI), flow index (FI), vascularization flow index (VFI) and mean grayness (MG) [11] (Fig. 1).

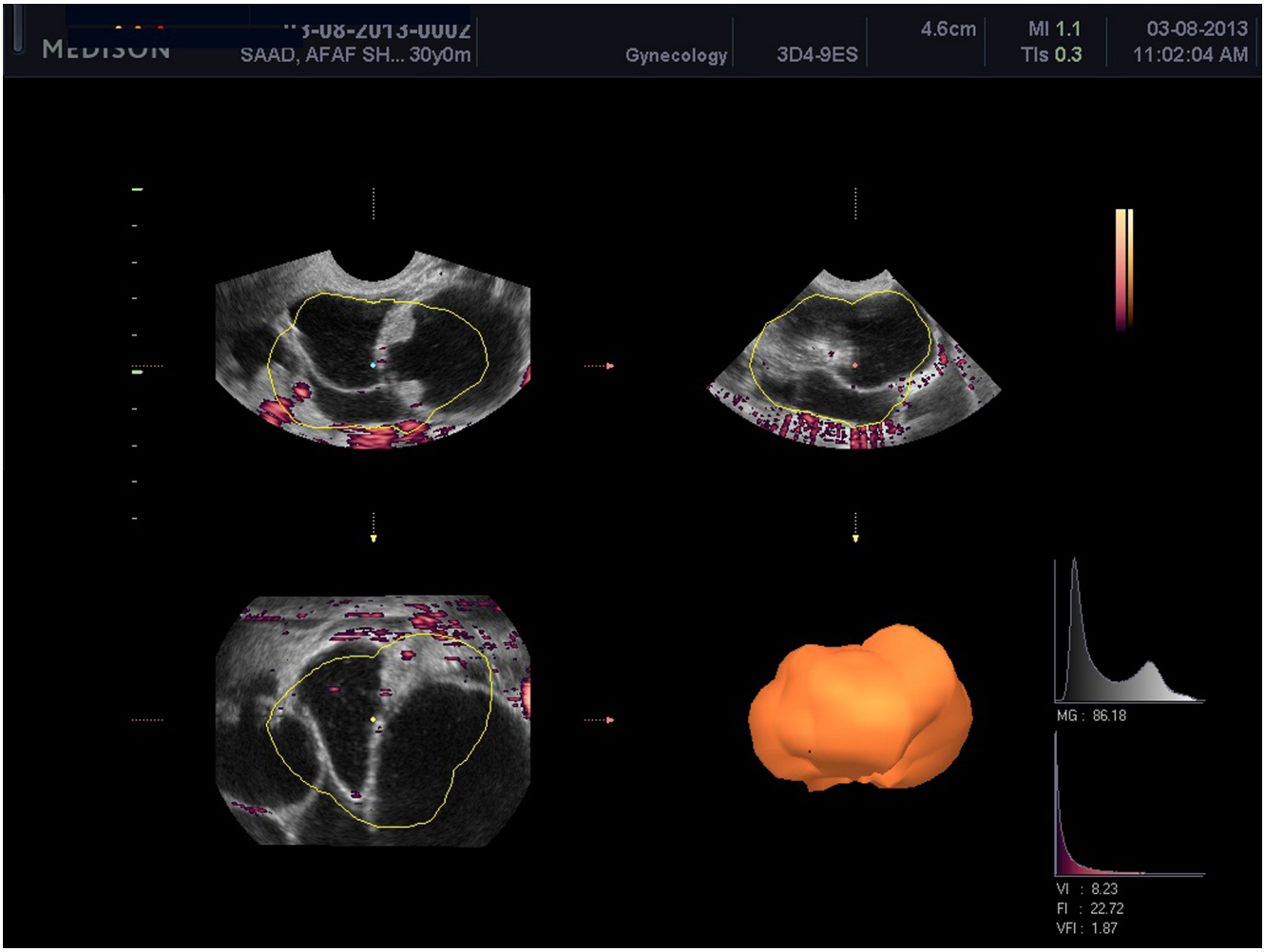

Fig. 1. 3DPD evaluation of multilocular ovarian cyst with vascular indices calculation using the histogram function automatically delineated by the machine.

Please cite this article in press as: A.M. Abbas et al., Three-dimensional power Doppler ultrasonography in evaluation of adnexal masses, Middle East Fertil Soc J (2017), http://dx.doi.org/10.1016/j.mefs.2017.03.004