COLOUR DOPPLER ECHOCARDIOGRAPHY IN THE MANAGEMENT OF CONGENITAL HEART DISEASE

Col V VATWANI*, Maj R GHULIANI+

ABSTRACT

Twenty patients with various forms of congenital heart disease admitted to Army Hospital Delhi Cantt were studied. After detailed clinical examination and routine investigations they were subjected to two dimensional and subsequently colour Doppler echocardiography. Two patients were operated on the data obtained by echocardiography studies only. Seven patients required preoperative catheterisation in addition to echographic examination. The operative procedures confirmed the lesions delineated on colour Doppler echocardiography. Three patients are on echocardiographic review and remaining seven are awaiting surgery to further confirm the diagnosis offered on colour Doppler echo. One patient of complex lesion died before detailed evaluation could be carried out. Thus colour Doppler echocardiography, though considered highly accurate and non invasive investigation for assessment of congenital heart disease is still in the stage of infancy in paediatric set up and requires a high degree of expertise before it can replace preoperative catheterisation in majority of cases.

MJAFI 1994; 50 : 19-22

KEY WORDS : Colour Doppler Echo; Congenital heart disease

Introduction

In the last decade, non invasive cardiovascular imaging and haemodynamic assessment have revolutionised the management of congenital heart disease (CHD) and have often rendered cardiac catheterisation unnecessary specially in cases of atrial septal defect [1,2]. Two dimension echocardiography (Echo) can be used to study congenital malformations, valvular structure and function, sub-valvular structures, ventricular function, ejection fraction, intracavity masses, pericardial disease and other structures [3]. Using two dimension colour coded Doppler flow imaging, both the time course and spatial blood flow in the heart can be rapidly visualised and co-related with cardiac structures. The colour modality acts as an angiogram in revealing the direction of flow, abnormal flow patterns and subjectively the volume of flow through shunts and regurgitant lesions. The blood flow infor-

mation provided by colour flow imaging often outlines small defects that are not well seen with conventional Echo. The result is a non invasive colour angiogram of the two dimensional image of the cardiac anatomy with a colour representation of blood as it flows through the anatomy [4,5].

In colour flow imaging, direction is indicated by one of the two possible colour ranges of red or blue. Velocity of blood flow is represented by the colour intensity within this colour range. The higher the velocity of flow, the brighter is the colour display. The flows towards the transducer are shown as increasing brightness of red and flows away as increasing brightness of blue with colour proportional to the velocity [6,7]. In this manner, Doppler colour flow imaging clearly shows areas of normal flow, abnormal flow and turbulent jets [8].

Definitive diagnosis can be made before catheterisation in many conditions and in

* Senior Adviser (Paediatrics), Comd Hosp (North Comd) C/o 56 APO; + Trainee Officer Paediatrics, Army Hospital, DELHI CANTT-110 010.

many other lesions catheterisation can be avoided altogether and patients can be operated upon purely on Echo data [9-11]. Present study was undertaken to evaluate the efficacy of colour Doppler Echo in the diagnosis and management of CHD.

Material and Methods

Twenty children with various types of CHD admitted to Army Hospital Delhi Cantt during the period from Apr 90 to Mar 91 were studied. The patients were clinically assessed and relevant laboratory investigations including electrocardiographic studies were carried out on them. Subsequently these patients were subjected to two dimension Echo, colour Doppler Echo and colour M mode studies at Central Medical Establishment (Air Force), Delhi Cantt.

Two dimensional Echo, Doppler, M-mode and colour Doppler studies were carried out on a WING MED CFM 700 colour Echo machine using a special specific paediatric Echo probe of 5 mega hertz frequency. Appropriate and relevant portions of these studies were recorded on a video cassette for subsequent evaluation and in certain cases on special recording paper for further reference.

Results

Twenty patients of various forms of CHD admitted for corrective or palliative surgery or in whom the disease had been recently detected were studied. Their age and sex distribution is given in Table 1. The types of CHD studied are depicted in Table 2. The subsequent investigations, management and outcome of these patients are shown in Table 3.

Two of the patients, one with an atrial

TABLE 1
Age and sex distribution of patients

Age Group	Male	Female
1 - 3 years	6	4
4 - 6 years	2	2
7 - 9 years	3	1
10 - 12 years	1	1
Total	12	8

TABLE 2

Various types of lesions studied

Lesion	No of patients
VSD	01
VSD with PS	02
VSD with pulmonary atresia	01
VSD with ASD	02
VSD with PDA	02
ASD	01
PDA	01
Coarctation of aorta	01
Aorto-pulmonary window	01
Tetralogy of Fallot	04
Transposition of great arteries	01
Single ventricle	01
Complex lesions	02
Total	20

TABLE 3

Management and outcome of patients

Number of patients operated	09
(a) Based on echo only	02
(b) On echo and cath findings	07
Number of patients on echo follow up	03
Number of patients awaiting surgery	07
Number of patients of complex lesion died before catheterisation	01
Total	20

septal defect (ASD) and one with a patent ductus arteriosus (PDA) were operated upon without these patients undergoing cardiac catheterisation i.e., on the data solely based on Echo and colour doppler studies.

Discussion

Cardiac catheterisation and angiography are comparatively risky procedures and though the incidence of mortality and morbidity is low, certain complications are known to occur. Furthermore with the advent of colour Doppler Echo, the anatomical and haemodynamic data gathered are as good and in certain lesions considered better in comparison to cardiac catheterisation. During this study it was realised that one of the most important aspects in assessment was the experience and technical skill of the physician performing the Doppler studies and its interpretation.

angiography had to be resorted to obtain the exact anatomical data, especially in patients who were to be taken for surgery.

In almost all of our cases the diagnosis given by colour Doppler Echo were confirmed either by cardiac catheterisation or surgery, thus proving the efficacy of this non invasive mode of investigation in CHD.

REFERENCES

1. Popp RL. Echocardiography (part 2). *New Eng J Med* 1990; 323 : 168-78.
2. George B. Coarctation of Aorta - Repair without cardiac catheterisation in infants. *Am Heart J* 1987; 114 : 1421-5.
3. Nishimura RA. Doppler echocardiography : Theory, instrumentation, technique and application. *Mayo Clin Proc* 1985; 60 : 321-43.
4. Sahn DJ. Real time two dimensional echocardiographic colour flow mapping. *Circulation* 1984; 71 : 849-53.
5. Igdbeshian VN. Colour Doppler imaging - an overview. *J Am Osteopath Assoc* 1988; 88(10) : 1273-6.
6. Sahn DJ. Application of colour flow mapping in paediatric cardiology. *Cardiol Clin* 1989; 7(6) : 25-263.
7. Shah KD. Colour doppler echocardiography in congenital heart disease. *Indian Pediatr* 1988; 25 : 125-31.
8. Sutherland GR. Colour flow mapping in cardiology. Indications and limitation. *Br Med Bull* 1989; 45(4) : 1076-91.
9. Freed MD. Is routine preoperative cardiac catheterisation necessary before repair of secundum and sinus venosus atrial septal defect? *J Am Coll Cardiol* 1984; 4 : 339-43.
10. Editorial. Doppler echocardiography. *Indian Pediatr* 1988; 25 : 121-3.
11. Borow KM. Non invasive assessment of valvular heart disease surgery without catheterisation. *Am Heart J* 1983; 106 : 443-9.
12. Kitakabe A. Non invasive evaluation of pulmonary hypertension by a pulsed Doppler technique. *Circulation* 1983; 68 : 302-9.
13. Suzuki Y, Kambara H. Detection of intracardiac shunt flow in atrial septal defect using a real time two dimension colour coded Doppler flow imaging system and comparison with contrast two dimension echocardiography. *Am J Cardiol* 1985; 56 : 347-50.
14. Levin R, Spach NS. Atrial pressure flow dynamics in atrial septal defects (Secundum type). *Circulation* 1968; 37 : 476-88.
15. Sahn DJ, Seven RE. Two dimension colour flow mapping for evaluation of ventricular septal defect shunts. A new diagnostic modality. *Circulation* 1984; (Supps), 2 : 2-364.
16. Liao PK, Su WJ, Hung JS. Doppler echo flow characteristics of isolated patent ductus arteriosus delineation by doppler colour flow mapping. *J Am Coll Cardiol* 1988; 12 : 1285-91.
17. Swensson RE. Real time colour flow mapping for detection of PDA. *J Am Coll Cardiol* 1986; 8 : 1105-10.
18. Sahn DJ, Simpson IA. Colour Doppler flow mapping observations in coarctation of aorta (Abstr). *Circulation* 1987; 76 (Suppl 4) : 174.
19. Flanagan MF. Tetralogy of Fallot with obstruction of ventricular septal defect spectrum of echo findings. *J Am Coll Cardiol* 1988; 11 : 386-90.
20. Alboliras ET, Chin AJ. Detection of aorta - pulmonary window by pulsed and colour Doppler echo. *Am Heart J* 1988; 115 : 900-2.