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SUMMARY OF THE FOURTH REPORT ON THE DIAGNOSIS, EVALUATION, AND TREATMENT OF HIGH BLOOD PRESSURE IN CHILDREN AND ADOLESCENTS

By Elaine M. Urbina, MD

The Working Group on High Blood Pressure in Children and Adolescents has now published The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents (www.nhlbi.nih.gov/guidelines/hypertension/child_tbl.htm).[1] This important publication, from the National High Blood Pressure Education Program, updates the previous 1996 guidelines. In the report, the Working Group re-examined data collected from many previous epidemiologic studies of blood pressure (BP) levels in children and data added from the 1999-2000 National Health and Nutrition Examination Survey (NHANES). Issues surrounding instrumentation for BP measurement in children were examined and the evidence for target-organ damage in hypertensive children was reviewed. Finally, the results of recent studies on antihypertensive therapy in the young were discussed and therapeutic guidelines were compiled. Therefore, the Fourth Report provides the newest evidence-based guidelines for clinicians on evaluation and management of children with hypertension (HTN).

Definition of Hypertension

High BP in children and adolescents remains defined by BP percentiles. Hypertension is defined as average systolic and/or diastolic BP that is >95th percentile for gender, age, and height on three or more separate occasions. A BP level that is >90th percentile but <95th percentile is now termed "prehypertension." However, for adolescents of 12 years or older, the adult definition of prehypertension is used

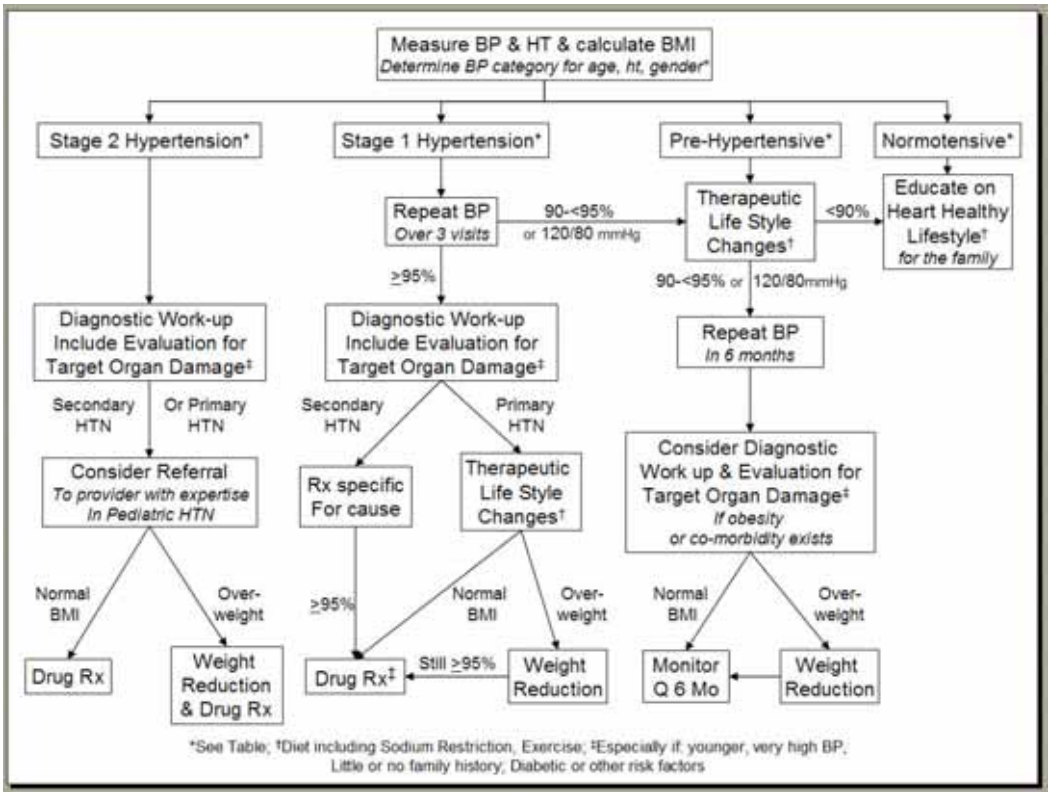

Figure 1. Algorithm for the diagnosis and treatment of hypertension in children.

(>120/80 mmHg but <95th percentile). This is because the 90th percentile for systolic BP is greater than 120 mmHg by this age regardless of body size. A method for staging the severity of hypertension has also been provided. Stage 1 hypertension is from the 95th percentile to the 99th percentile plus 5 mmHg. This level was selected because the difference between the 95th and 99th percentiles is only 7-8 mmHg which may not be a large enough range to account for normal BP variability between visits. Stage 2 hypertension is generally about 12 mmHg or more above the 95th percentile and represents a level of BP that should result in further evaluation within 1 week or immediately if the patient is symptomatic.

Measurement of Blood Pressure in Children

The first step in diagnosing hypertension is taking BP measurements as part of all well child visits starting at 3 years of age. There are also special circumstances, such as congenital anomalies, or history of urinary tract disorders, when children less than 3 years of age should also have their BP measured regularly.

The proper method for measuring BP includes appropriate cuff size selection. Recommendations are provided that are consistent with American Heart Association guidelines (Table 1). Since the BP tables used to establish a diagnosis of hypertension are based on auscultatory measurements, this is the preferred method of measurement. However, oscillometric devices are convenient and are frequently used as replacements for mercury manometers. Unfortunately, these instruments do not provide measurements that are identical to auscultation, therefore, aneroid manometers which are quite accurate when calibrated regularly, are the recommended alternative to mercury column devices.

Age Range	Width (cm)	Length (cm)	Maximum Arm Circumference (cm)*
Newborn	4	8	10
Infant	6	12	15
Child	9	18	21
Small Adult	10	24	26
Adult	13	30	34
Large Adult	16	38	44
Thigh	20	42	52

Table 1. Recommended Dimensions for BP Cuff Bladders

Blood Pressure Tables

The new BP tables included in the report reflect revisions based on the inclusion of the new CDC height percentiles (www.cdc.gov/growthcharts) and the NHANES (1999-2000) BP data. Despite these additions, there is minimal change from the 1996 report[2] in the numbers that designate the 90th and 95th percentile for systolic or diastolic BP. However, the 50th percentile has been added to provide clinicians with the midpoint of the normal BP range and the 99th percentile should be used to stratify or stage the hypertension.

Evaluation of Hypertension in Children

The extent and timing of evaluation and treatment for hypertension are based on the BP classification. Children with prehypertension should be re-evaluated in 6 months. Stage 1 hypertension requires additional measurements within a few weeks while children with Stage 2 hypertension should be referred to a source of care within one week. All children with definite hypertension should undergo a basic evaluation for identifiable causes. A complete history and physical should include sleep pattern and lifestyles that influence CV risk such as diet, exercise, smoking, drug and alcohol use. Recommended initial laboratory evaluation includes BUN, creatinine, electrolytes, urinalysis, urine culture, CBC. Evaluation for co-morbidity should include a fasting lipid panel and glucose level. Although the usefulness of more extensive evaluation for secondary hypertension is controversial, the report does recommend a renal ultrasound to rule out congenital anomalies or scars.

One of the major changes in the evaluation schema is the emphasis on evaluation for the presence of target organ damage related to hypertension. Autopsy studies such as the Bogalusa Heart and Pathobiologic Determinates of Atherosclerosis in Youth studies have demonstrated a significant relationship between BP and atherosclerosis. New noninvasive techniques using ultrasound confirm that childhood BP levels are related to carotid intima-media thickness and large artery compliance. Hypertensive target organ damage is not confined to the vascular system as renal damage may also occur. Urine microalbuminuria in adulthood representing subtle kidney damage has been found to relate to childhood BP levels in African-Americans. HTN is also a major risk factor for the progression of chronic renal insufficiency in children. Children with significant BP elevation can also develop decreased visual acuity and hypertension may also lead to neurocognitve dysfunction. At the present time, testing for vascular, renal and other types of target organ damage are not recommended for routine clinical use as additional research will be needed to evaluate their clinical utility.

"The Working Group on High Blood Pressure in Children and Adolescents has now published The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents (www.nhlbi.nih.gov/guidelines/hypertension/child_tbl.htm)."

"Although conservative estimates indicate that 1 to 3% of pediatric patients have hypertension, the epidemic of obesity we are facing is likely to increase this prevalence."

Class	Drug	Starting Dose	Maximum Dose
Angiotensin Converting Enzyme Inhibitor	Benazepril	0.2 mg/kg/day up to 10 mg QD	0.6 mg/kg/ay up to 40 mg QD
	Captopril	0.3-0.5 mg/kg/dose TID	6 mg/kg/day divided TID
	Enalapril	0.08 mg/kg/dose QD	0.6 mg/kg/day up to 40 mg QD
	Fosinopril	0.1 mg/kg/day up to 10 mg QD	0.6 mg/kg/day up to 40 mg QD
	Lisinopril	0.07 mg/kg/day up to 5 mg QD	0.61 mg/kg/day up to 40 mg QD
	Quinapril	5-10 mg QD	80 mg QD
Angiotensin Receptor Blocker	Irbesartan	75-150 mg QD	300 mg QD
	Losartan	0.75 mg/kg/day up to 50 mg QD	1.44 mg/kg/day up to 100 mg QD
α- and ß-antagonist	Labetalol	2-3 mg/kg/day divided BID	10-12 mg/kg/day up to 2.4 gm/day divided BID
ß-antagonist	Atenolol	0.5-1 mg/kg/day QD or divided BID	2 mg/kg/day QD or divided BID
	Bisoprolol/HCTZ	2.5/6.25 mg QD	10/6.25 mg QD
	Metoprolol	1-2 mg/kg/day divided BID	6 mg/kg/day up to 200 mg/day divided BID
	Propranolol	1 mg/kg/day divided BID or TID	16 mg/kg/day divided BID or TID
Calcium Channel Blocker	Amlodipine	0.06 mg/kg/dose QD	0.34 mg/kg/day up to 10 mg QD
	Felodipine	2.5 mg QD	10 mg QD
	Isradipine	0.05-0.15 mg/kg/dose TID or QID	0.8 mg/kg/day up to 20 mg/day divided TID or QID
	Nifedipine XR	0.25-0.5 mg/kg/day QD or divided BID	3 mg/kg/day up to 180 QD or divided BID
Central α-agonist	Clonidine	0.05-0.1 mg/dose TID or QID	0.6 mg/day divided TID or QID
Diuretics	Furosemide	0.5-2.0 mg/kg/dose BID to QID	10-15 mg/kg/day divided BID to QID
	HCTZ	1 mg/kg/day divided BID	4 mg/kg/day divided BID
	Spironolactone	1 mg/kg/day QD or divided BID	3.3 mg/kg QD or divided BID
	Triamterene	1-2 mg/kg/day divided BID	3-4 mg/kg/day up to 300 mg/day divided BID
	Chlorthalidone	0.3 mg/kg QD	2 mg/kg/day up to 100 mg QD
	Amiloride	0.4-0.625 mg/kg QD	20 mg QD
Peripheral α-antagonist	Doxazosin	1 mg QD	4 mg QD
	Prazosin	0.05-0.1 mg/kg/day divided TID	0.5 mg/kg/day divided TID
	Terazosin	1 mg QD	20 mg QD
Vasodilators	Hydralazine	0.25 mg/kg/dose TID or QID	7.5 mg/kg/day up to 200 mg/day divided TID or QID
	Minoxidil	0.1-0.2 mg/kg/dose BID or TID	1 mg/kg/day up to 50 mg/day divided BID or TID

Table 2. Antihypertensive Agents for Hypertension in Children

However, there is an extensive body of data relating childhood HTN to cardiac involvement. LVH has been reported in nearly 40% of children and adolescents with only mild HTN and many of these children demonstrate a concentric hypertrophy pattern which is associated with elevated risk for adverse CV outcomes in adults. Therefore, the Fourth Report recommends an echocardiogram be performed on all hypertensive children prior to starting drug therapy. Measurement of LV size should be performed according to the American Society of Echocardiography guidelines[2] and LVM should be calculated with a validated equation (LVM (gm) = 0.80[1.04(IVS + LVED + LVPW)^3–(LVED)^3] + 0.6).[3] However, since body size is one of the major determinates of heart mass, LVM must be indexed to body size in order to compare children of different sizes. Several methods have been reported, but the method described by de Simone et.al.[4] (LVM/ht$^{2.7}$) is preferred since it accounts for the effect of lean body mass but excludes potentially adverse cardiac effects related to obesity. A conservative cut-point defining LVH is 51 gm/m$^{2.7}$. This is above the 99th percentile for children and adolescents and is associated with adverse CV outcomes in adults with HTN (de Simone 1992). However, it should be noted that the 95% for indexed LVM in normal children is actually less than 40 gm/m$^{2.7}$. Ascertainment of LVM is helpful in clinical decision making since in most patients LVH may be an indication for initiating or intensifying pharmacologic therapy to lower BP while serial echocardiograms can be obtained to determine effectiveness of therapy.

Treatment of Hypertension in Children

Family based therapeutic lifestyle changes are recommended for all children with hypertension and pre-hypertension. While weight reduction is the primary therapy for obesity-related hypertension, regular physical activity, restriction of sedentary activity, and dietary modification should be initiated in all patients.

The decision to initiate a pharmacologic therapy in children for a potentially life-

long condition is difficult. Therefore, specific indications for antihypertensive therapy in children are presented in the report. These include secondary HTN, symptomatic HTN, evidence for target organ damage, diabetes and BP levels that have failed to respond adequately to therapeutic lifestyle changes. Fortunately, much new data is available demonstrating the safety and efficacy of BP medications in children. Therefore, the Working Group was able to supply an updated table with the most current dosing recommendations for antihypertensive drugs in children (Table 2). Pharmacologic therapy should be initiated with a single drug with the goal for treatment reduction of BP to < 95th percentile unless concurrent conditions are present such as chronic renal disease or diabetes in which the target should be <90th percentile. Severe, symptomatic hypertension should be treated with intravenous antihypertensive drugs and the Fourth Report includes a table of pharmacologic agents which are preferred for this use. Periodic laboratory evaluation for side-effects should be incorporated into the treatment plan.

Although conservative estimates indicate that 1 to 3% of pediatric patients have hypertension, the epidemic of obesity we are facing is likely to increase this prevalence.[5] Therefore, a management algorithm is provided in the report to guide the practitioner (Figure 1). These guidelines emphasize a heart healthy lifestyle regardless of BP level and indicate where treatment of overweight should be considered. Finally, they emphasize echocardiography for evaluation of cardiac involvement prior to drug therapy.

Hopefully, this important new report will encourage efforts to identify and manage hypertension in the young thereby reducing risk for future adverse cardiovascular events.

References

1. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. *The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents.* Pediatrics. 2004;114(Suppl 2):1-22.

2. Sahn DJ, DeMaria A, Kisslo J, Weyman A. *Recommendations regarding quantitation in M mode echocardiography: results of a survey of echocardiographic measurements: the committee on M-mode standardization of the American Society of Echocardiography*. Circulation. 1978;58:1072-1083.

3. De Simone G, Daniels SR, Devereux RB, Meyer RA, Roman MJ, de Divitiis O, Alderman MH. *Left ventricular mass and body size in normotensive children and adults: assessment of allometric relations and impact of overweight*. J Am Coll Cardiol. 1992;20:1251-1260.

4. Devereux RB. *Detection of left ventricular hypertrophy by M-mode echocardiography: anatomic validation, standardization, and comparison to other methods*. Hypertension. 1987;9(suppl II):II-19- II-26.

5. Munter P, He J, Cutler JA, Wildman RP, Whelton PK. *Trends in blood pressure among children and adolescents*. JAMA. 2004;291:2107-2113.

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MEDICAL CONFERENCES

9th Annual Meeting of the European British Society of Interventional Radiology
November 2-4, 2004; North Yorkshire, UK
www.bsir.org

77th American Heart Association Scientific Sessions 2004
November 7-10, 2004; New Orleans, LA
scientificsessions.americanheart.org/portal/scientificsessions/ss/

Pediatric Cardiac Intensive Care
December 1- 4, 2004; Miami, FL
www.PCICsymposium.org

International Meeting on Interventional Cardiology
Dec 6-7 2004; Tel Aviv, Israel
www.kenes.com/intercard/

2nd Asian Pacific Congress of Heart Failure 2005 (Asian Pacific Society of Cardiology, World Heart Federation)
January 10 –12, 2005; Singapore
www.mpgroupasia.com/event.htm

41st Annual Meeting of The Society of Thoracic Surgeons (STS)
January 24 – 26, 2005; Tampa, FL
www.sts.org

ACC (American College of Cardiology) 54th Annual Scientific Session 2005
March 6-9, 2005 Orlando, FL
www.acc.org

2005 SIR (Society of Interventional Radiology) 30th Annual Scientific Meeting
March 31 - April 5, 2005; New Orleans, LA
www.sirweb.org

AATS (American Association for Thoracic Surgery) 85th Annual Meeting
April 10 –13, 2005; San Francisco, CA
www.aats.org/annualmeeting/

Third Biennial Meeting of the Society for Heart Valve Disease (SHVD)
June 17-20, 2005; Vancouver, Canada
www.shvd.org/

MEDICAL NEWS

Herbal Preparations May Produce Adverse Cardiovascular Complications in Children

NYU Medical Center's Department of Pediatric Cardiology reports use of alternative therapies in children poses cardiovascular risks. Michael Artman, MD, FAAP, Director of Pediatric Cardiology at NYU Medical Center presented information at the National Conference of the American Academy of Pediatrics (AAP) in San Francisco regarding the potential risk of using complementary and alternative medical therapies, particularly the use of common herbs and nutritional supplements, and their adverse implications on the cardiovascular systems of children. According to Artman, "This is a growing national problem. In adults, approximately 50% use some form of complementary medicine. Annual spending is over 5 billion dollars on herbal products and 2 billion on dietary supplements in the US. It is growing with children."

To date, there is little documented evidence if these alternative therapies are safe and/or effective. Most products are not standardized, vary wide in concentration and components, and there is little or no data on utilization, prevalence, efficacy, and acute/chronic toxicity in children.

One common herb with demonstrated cardiovascular activity is ephedra, a Chinese herb that is a mixture of several different chemicals and used for asthma, weight loss, energy booster. The drugs in ephedra can cause high blood pressure, palpitations, stroke, and death. Garlic, another common herbal supplement, can interfere with platelet aggregation; and some cardiac medications, such as blood thinners, when combined with garlic supplements can increase the risk of stroke or excessive bleeding following surgery.

Artman urged the pediatric practitioners not to underestimate the magnitude of CAM (Complementary and Alternative Medicine) utilization in their patients and to document CAM requests, discussions, and responses in the patient's medical records. "Alternative therapies are potentially quite toxic with minimal benefit and should not be recommended," stated Artman. "Healthcare providers must be alert to potential adverse effects and drug interactions due to herbal medications."

For more information : http://www.med.nyu.edu/

Post-traumatic Stress Disorder Increases in Children with Extended ICU Stays After Cardiac Surgery

A study published in the April issue of The Journal of Pediatrics shows that the occurrence of Post-traumatic Stress Disorder (PTSD) increases significantly in school-age children who experience extended stays in the Intensive Care Unit (ICU) following cardiac surgery.

The study, led by Dana Connolly, PhD., Assistant Professor of Pediatrics at New York University School of Medicine in collaboration with Michael Artman, MD, Director of Pediatric Cardiology at New York University School of Medicine, is the first of its kind to examine the psychosocial responses of school-age children to cardiac surgery. Forty-three families participated in the study, which took place at New York University Medical Center and Children's Medical Center in Dallas. The children from 5 to 12 years of age underwent cardiac surgery for congenital heart defects. Each child was evaluated pre- and post-operatively for PTSD using tools that determine anxiety disorders, nonverbal reasoning, and temperament. None of the children showed signs of PTSD before surgery.

During the post-surgical assessment, researchers found that characteristics of PTSD increased in children who stayed in the ICU for more than 48 hours after surgery. After hospitalization, five (12%) of the children met diagnostic criteria for PTSD, and five (12%) exhibited some of the characteristics of PTSD, including disorganized behavior, nightmares, sleep disorders, and concentration problems. Children exhibiting signs of PTSD were referred to pediatric psychiatrists for further evaluation.

"It's important for parents to look for behavioral changes such as bed wetting, night screams, clinging, and concentration problems once the child comes home from surgery," says Dr. Connolly. Despite efforts to minimize the stress and emotional trauma that can be associated with heart surgery for children and their families, the study showed, for the first time, a clinically significant risk of PTSD after cardiac surgery in pediatric patients.

According to Dr. Artman, "Even though this was a relatively small sample, it is impressive that roughly 1 in 10 children develop full blown post-traumatic stress disorder after undergoing heart surgery. The only factor we found that seemed to correlate with PTSD was a stay of more than 48 hours in the ICU, which is really not very long. Presently, we don't know what factors in the ICU might be contributing, but our new findings clearly demonstrate the need for future research."

Congenital heart disease affects 1 in 100 newborn babies each year, according to the American Heart Association, and is the most common form of birth defect. In the U.S; approximately 35,000 children are born with a structural heart defect every year, and many require surgery.

For more information contact NYU's Department of Pediatric Cardiology at 212-263-5940

USE OF SYVEKPATCH® IN CHILDREN UNDERGOING CARDIAC CATHETERIZATION

By Ashish Madhok, MD; Devyani Chowdhury, MD; and Dipak Kholwadwala, MD

Introduction

Attaining hemostasis at the vascular access site following percutaneous catheterization is crucial. Traditionally, manual or mechanical compression has been the standard approach to achieve hemostasis. At our institution, in a child less than 3 years of age, the leg is immobilized using a leg-board and in older children and adolescents, a sandbag is used to compress the vascular access site following a cardiac catheterization procedure. All patients remain immobilized for about 4-6 hours to avoid bleeding. This process is time consuming, labor intensive and uncomfortable to the patient. In the past few years, a number of vascular closure devices have been used, primarily in the adult population. These devices decrease the time it takes to achieve hemostasis, and allow early ambulation and discharge from the hospital. Recent reports have documented serious groin infections and vascular obstruction with certain of these closure devices[1]. In addition, these devices are not approved for pediatric patients. In this article, we will report our experience with application of the SyvekPatch® for vascular hemostasis in children undergoing cardiac catheterization.

"This study demonstrates that the SyvekPatch® is safe, easy and provides adequate hemostasis."

Introduction of the Product

In December 1998, SyvekPatch® received FDA clearance "for use in the local management of bleeding wounds such as vascular access sites, percutaneous catheters or tubes or surgical debridement." It consists of a specific formulation of Marine Polymer Technologies (Danvers, Massachusetts) proprietary polymer poly-N-acetyl glucosamine (pGlcNAc), which is isolated from marine microalgae. The pGlcNAc material is a catalytic surface that accelerates the concentration of red blood cells, clotting factors and platelets at the bleeding site towards the critical levels needed for clot formation. It also induces local vasoconstriction and produces a stronger clot. Its effectiveness has been shown in a wide range of animal studies and pre-clinical trials of medically and genetically induced coagulopathy and hemorrhage.[2-5] Nader et al[6], have studied the efficacy of SyvekPatch® in 1000 consecutive adult patients undergoing interventional, electro-physiologic and diagnostic cardiac catheterizations. The use of SyvekPatch® in this population caused rare major complication (0.1%) and a few minor complications (1.3%). This study concluded that SyvekPatch® was safe and effective in adults undergoing cardiac catheterization.

ACT duration in seconds	Pressure held in minutes
<200	10
200-300	20
>300	Protamine given and 20 minutes pressure
Interventional catheterizations	20

Table I. ACT duration and manual pressure chart.

Methods

The Institutional Review Board approved the study. At the conclusion of the catheterizations 2-mls blood was drawn to determine the ACT (Activated coagulation time in seconds). Then a 3-cm x3 cm poly-n-acetylglucosamine-treated patch (SyvekPatch®) was topically placed at the puncture site. A single patch was used for both the arterial and venous puncture in the same femoral area. As initially recommended by the manufacturers the duration of manual pressure was applied between 10-20 minutes based on the ACT. If the ACT was > 300 then protamine IV was given and manual pressure held for 20 minutes (Refer Table I). The patients who could ambulate were encouraged to do so in 2 hours and same day admit patients were discharged in 4-6 hours.

	Diagnostic	Interventional (including EPS)	Total
Catheterizations	30 (40.5%)	44 (59.5%)	74
Re-bleeding	4	2	6
Small hematoma	1	1	2

Table II. Trial summary and results

Patient Demographics

A total of 74 patients were included in the study (35 males and 39 females). Age: birth to 18 years, (mean of 7.14 ± 5.50 years)

Procedures

A total of 74 catheterizations were performed which included 30 diagnostic, 36 interventional and 8 electrophysiological procedures. There were a total of 148 puncture sites and 97 SyvekPatches® were applied over the puncture sites (a single SyvekPatch® was used for both arterial and venous puncture sites in the same femoral area). The catheter sheath sizes ranged from 3 to 11 French.

Study Endpoints

The primary endpoint of the study was to determine the incidence of major or minor complications at the vascular access site. Major complications were defined as:

1) loss of pulse requiring medical or surgical treatment;
2) excessive blood loss from puncture site requiring blood transfusion;
3) groin infection requiring antibiotics;
4) local skin rash requiring treatment. Minor complications were defined as occurrence of small hematomas (size<2.5 cm).

Failure of SyvekPatch® was defined as rebleeding requiring additional manual recompression.

Results

Outcomes measured included clinical hemostasis, safety and complication rates.

Ninety-seven SyvekPatches® were used in 74 patients. There were no major complication and two minor complications (1.94%). Failure of SyvekPatch® was seen in 6 patients (6.18%) where additional manual recompression was used to control minor bleeding. (Refer Table II). The ACT duration was < 300 in all these 6 patients. There was no association between rebleeding, age of patient, the sheath size or the type of procedure.

Discussion

This study demonstrates that the SyvekPatch® is safe, easy and provides adequate hemostasis. Since no comparison was made against the usual gauze compression method, SyvekPatch's® hemostatic superiority cannot be proved. There was a trend noted towards early ambulation and discharge. This may have resulted from a bias on the physicians' side, to feel more comfortable with earlier ambulation and discharge because of increased confidence in the hemostasis. It seems this was justified in view of the fact that there were no complications after discharge. Failure of the SyvekPatch® to achieve adequate hemostasis was seen in uncooperative patients awakening from anesthesia. We have changed our practice to apply additional pressure in this higher risk group of patients when they are agitated or uncooperative. We have also discontinued prolonged immobilization and the practice of using a leg-board or sand bag. The currently available SyvekPatchNT® can now be applied for 6 minutes for diagnostic and 12 minutes for interventional procedures. Thus, decreasing the time it takes to achieve hemostasis following cardiac catheterization without increasing post-procedural complications has the potential to optimize recovery bed utilization, reduce hospital costs and improve patient comfort. Before a more routine use of this technique can be widely recommended, a randomized trial is suggested to demonstrate the superiority of the SyvekPatch® in the pediatric population.

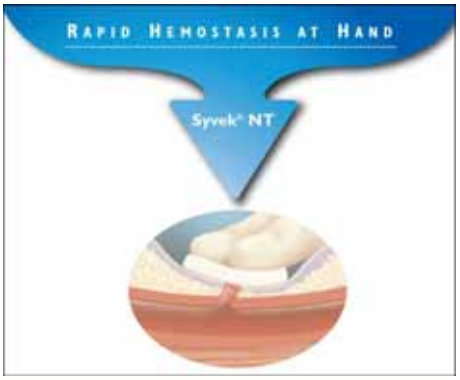

Figure 1. Syvek® NT

References

1. Pipkin W, Brophy C, Nesbit R, Mondy Iii JS. *Early experience with infectious complications of percutaneous femoral artery closure devices*. J Vasc Surg 2000; 32:205-208.

2. Cole DJ, Connolly RJ, Chan MW, Schwaitzberg SD, Byrne TK, Adams DB, Baron PL, O'Brien PH, Metcalf JS, Demcheva M, Vournakis J. *A pilot study evaluating the efficacy of a fully acetylated poly-N-acetyl glucosamine membrane formulation as a topical hemostatic agent*. Surgery 1999; 126:510-517.

3. Kulling D, Vournakis J, Woo S, Demcheva MV, Tagge DU, Rios G, Finkielsztein S, Hawes RH. *Endoscopic injection of bleeding esophageal varices with a poly-N-acetyl glucosamine gel formulation in the canine portal hypertension model*. Gastrointest Endosc 1999; 49:764-771.

4. Meyer. *Control of post dialysis bleeding in patients on chronic anticoagulation therapy.* Presented at the American Society of Nephrology Meeting, 1999.

5. Chan MW, Schwaitzberg SD, Demcheva M, Vournakis J, Finkielsztein S B, Connolly RJ. *Preclinical comparison of p-G1cNAc with absorbable collagen (Actifoam) and fibrin sealant for achieving hemostasis in a swine model of splenic hemorrhage*. J Trauma 2000; 48:454-458.

6. Nader RG, Garcia JC, Drushal K, Pesek T. *Clinical evaluation of the SyvekPatch in consecutive patients undergoing Interventional, EPS and diagnostic cardiac catheterization procedures.* J Invas Cardiol 2002; 14:305-307.

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Dr. John Rhodes of Duke Children's Hospital is the winner of the "Illustrated Field Guide to Congenital Heart Disease and Repair" from Scientific Software Solutions (www.PedHeart.com). Dr. Rhodes' name was randomly drawn on October 23, 2004 from business cards dropped of at the Pediatric Cardiology Today booth at PICS VIII in Chicago, IL

USEFUL WEBSITES

American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR)
www.aacvpr.org

American Board of Pediatrics (ABP)
www.abp.org/abpfr.htm

International Network of Agencies for Health Technology Assessment (INAHTA)
www.inahta.org

MedlinePlus—Congenital Heart Disease
www.nlm.nih.gov/medlineplus/congenitalheartdisease.html

MedlinePlus—Drug Information
www.nlm.nih.gov/medlineplus/druginformation.html

National Center for Biotechnology Information (US National Library of Medicine)
www.ncbi.nlm.nih.gov/

The National Human Genome Research Institute (National Institutes of Health)
www.genome.gov

Children's Cardiomyopathy Foundation
www.childrenscardiomyopathy.org

Center for Drug Evaluation & Research (CDER) - FDA
www.fda.gov/cder/

Barth Syndrome Foundation
www.barthsyndrome.org

The Hypertrophic Cardiomyopathy Association (HCMA)
www.4hcm.org/home.php

Office of Rare Diseases (National Institutes of Health—NIH
http://rarediseases.info.nih.gov/

The Teratology Society
www.teratology.org

LIVE 3D ECHO DELIVERS REAL-TIME BENEFITS IN PEDIATRIC CARDIAC CARE

By Girish Shirali, MD

As cardiac ultrasound technology evolves from 2D to Live 3D echocardiography, the medical community is rapidly realizing important benefits in the field of pediatric cardiology. A new and exciting aspect has been the ability to use Live 3D echo to capture a surgical view of a patient's heart, which is critical in surgical planning. Other benefits in using Live 3D echo to scan children include rapid image acquisition time, especially advantageous in scanning young children who cannot sit and lie still for extended periods of time, scanning does not require sedation and is free of any ionizing radiation, and a full-volume image can be reviewed offline without the need for additional scans.

Live 3D echo gives us different levels of information that could not be obtained before, since real-time images of the heart are displayed instantly on the monitor as a patient is scanned. It is the real-time aspect of this technology that is critical in obtaining a precise diagnosis. Using 3D, images can be rotated and cropped to view the heart from all angles. As a result, we are able to obtain a complete view from multiple perspectives, which provide immediate and improved perspective on spatial relationships – images that are not available using conventional 2D echo. These tools enable the physician to make a more accurate diagnosis – and give surgeons an advantage in pre-surgical planning.

Figure 1. Pediatric Pulmonic Stenosis

At the pediatric echocardiography clinic at the Medical University of South Carolina, Live 3D echo has been instrumental in helping us better diagnose the exact nature of a condition and determine an appropriate course of action. One example is the case of a 14-year-old male who had been diagnosed with hypertrophic cardiomyopathy. Two-dimensional echo showed that the patient had left ventricular hypertrophy and a peak outflow tract gradient of 110 mm Hg. However, the patient did not have some of the classic features of hypertrophic cardiomyopathy. For example, his ventricular hypertrophy was diffuse, not asymmetric, and there was no systolic anterior motion of the mitral valve. Additionally, the mitral valve had a prominent abnormal accessory papillary muscle. Live 3D echo showed that this accessory papillary muscle originated on the anterolateral wall of the left ventricle and had an attachment to the anterior mitral leaflet midway between the hinge and the tip of the leaflet via a few very short chordae tendineae. Live 3D echo demonstrated the surgeon's view of exactly where the abnormal chordae inserted. The mechanism of the left ventricular tract obstruction in this case was that during ventricular systole, the accessory papillary muscle pulled the anterior mitral leaflet into the left ventricular outflow tract. This papillary muscle did not appear to have any chordae attaching to the tips of the mitral valve. Therefore, we felt that dividing the abnormal chordae would probably relieve the obstruction without compromising mitral valve function. Based on the 3D echo findings, the surgeon relieved subaortic obstruction by dividing the abnormal chordae and also performed septal myomectomy. Postoperative 2D and 3D echo revealed excellent relief of subaortic stenosis and no mitral regurgitation. Live 3D echo in this case demonstrated surgically correctable substrate for subaortic stenosis, and enabled the surgeon to customize the surgical approach.

> ***"Live 3D echo gives us different levels of information that could not be obtained before..."***

Figure 2. Pediatric Double Orifice Mitral Valve

"These three cases illustrate real-world examples of how Live 3D echo is relevant to surgery or other interventions by providing the ability to obtain volumetric imagery of the heart, and to crop and slice those images real-time in a manner that was not possible before."

Another case in which Live 3D echo was critical in providing a comprehensive diagnosis involved a 16-year-old female patient who had previously undergone left subclavian artery flap repair of aortic coarctation, followed by balloon angioplasty for recoarctation. For the past 8 years, we had been unable to visualize her descending aorta by 2D echocardiography. At a scheduled follow-up, she was found to have a new arm-leg blood pressure gradient of 40 mm Hg. We performed a Live 3D color echo with suppression of the black and white signal, thus providing an echo 'angiogram.' The Live 3D color echo demonstrated the entire descending aorta and clearly identified a prominent posterior shelf of re-coarctation. As a result of Live 3D echo, the patient did not need advanced imaging studies to demonstrate the aorta. We instead detected a substrate that would be amenable to balloon angioplasty.

Another example involved a 38-year-old female, who had first undergone surgery for subaortic stenosis 26 years ago at another institution. The patient developed recurrent subaortic stenosis with symptoms that included palpitations and chest pain. Two-dimensional echo revealed an ill-defined density in the left atrium. However, with 2D echo, it was not possible to determine the exact nature of the density. Use of Live 3D echo on the patient helped define the substrate for subaortic stenosis. It also revealed that the density was actually a catheter that had been inserted into the left atrium during the patient's surgery over 20 years ago. The monitoring line had presumably broken off, and the retained line in the atrium may well have contributed to her palpitations. It had not been detected previously because it was radiolucent. Live 3D echo gave the surgeon a real-time view of exactly what the problems were – critical in the surgeon's decision to extend the operation and remove the line, which was found to be encased in fibrin. If not for Live 3D echo, our team would not have seen the line in the patient's heart, which, if left untreated, could have led to stroke or heart rhythm problems.

These three cases illustrate real-world examples of how Live 3D echo is relevant to surgery or other interventions by providing the ability to obtain volumetric imagery of the heart, and to crop and slice those images real-time in a manner that was not possible before. By being able to view these images from relevant perspectives, surgeons now have the ability to prepare a precise surgical plan, minimizing surprises. In addition to pre-operative planning, Live 3D echo is important in evaluating and monitoring surgical outcomes by performing real-time assessments of repairs, thus improving the level of patient care and hopefully contribute to improving outcomes.

For comments to this article, send email to: OCTL3D@PediatricCardiologyToday.com

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BOOK REVIEW: ILLUSTRATED FIELD GUIDE TO CONGENITAL HEART DISEASE AND REPAIR

By John W. Moore, MD

Take a look at the "Illustrated Field Guide to Congenital Heart Disease and Repair." (Figure 1) The First Edition of this manual developed and published by Scientific Software Solutions, Charlottesville, VA is available through their website, www.PedHeart.com.

This manual is pocket-sized and ring-bound. It can be placed in your lab coat and taken on hospital rounds. Allen Everett, MD (Johns Hopkins University) and D. Scott Lim, MD (University of Virginia) are the principal authors. In addition, Benjamin Peeler, MD (University of Virginia) and Luca Vricella, MD (Johns Hopkins University) contributed a substantial Section on Congenital Heart Surgeries. The Guide covers the normal and fetal heart, congenital heart defects, diagnostic and interventional catheterization, and congenital heart surgeries.

The text is brief, basic, and accurate. It is easy to read, and has been written at a level which educated lay people can understand. The manual is also useful for education of hospital staff, medical students and perhaps also house officers, and general physicians e.g. pediatricians and family practitioners. This is not, nor is it intended to be, an educational tool for pediatric cardiology fellows, pediatric cardiologists or other advanced physicians.

> ***"The outstanding feature of the 'Illustrated Field Guide' is the illustrations provided by Paul and Jasper Burns."***

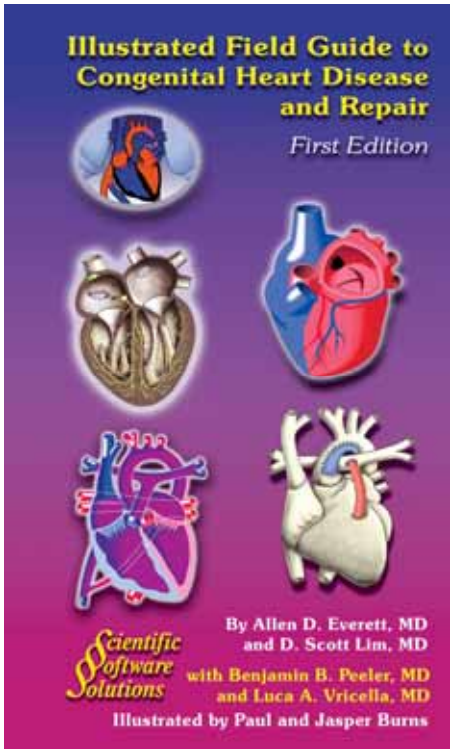

Figure I. Cover of "Illustrated Field Guide to Congenital Heart Disease and Repair."

The outstanding feature of the "Illustrated Field Guide" is the illustrations provided by Paul and Jasper Burns. There are dozens of excellent anatomical pictures and diagrams of the normal heart, heart defects and common surgical repairs. These illustrations are enhanced by the thoughtful use of the colors blue and pink to support the discussions of physiology in the text. They are also well labeled and designed to emphasize the essential features of each defect or operation. These illustrations will be immensely useful in the numerous daily discussions we have with patients, families, staff, students, and non-specialists.

The Guide has weaknesses. The Preface acknowledges that a section on electrophysiology is in preparation. The authors and publisher might also consider adding sections on transplantation, commonly used medications, and perhaps fetal interventions. Furthermore, the section on interventional catheterization is spotty and incomplete. Many of the angiograms and pictures of devices are not of high quality. This section should be improved in the next edition.

All considered, I enjoyed the Field Guide very much. Like many Pediatric Cardiology Today readers, I am in the "field" most days and need to explain complicated heart defects and surgeries to a variety of people. This manual will be very useful in my day to day work.

For comments to this article, send email to: OCTJWM@PediatricCardiologyToday.com

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