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Circulation. 2003;108:2550-2564

doi: 10.1161/01.CIR.0000100561.76609.64

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

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Print ISSN: 0009-7322. Online ISSN: 1524-4539

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Recommendations for Preparing Children and Adolescents for Invasive Cardiac Procedures

A Statement From the American Heart Association Pediatric Nursing Subcommittee of the Council on Cardiovascular Nursing in Collaboration With the Council on Cardiovascular Diseases of the Young

Writing Committee

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Staged surgical repair and interventional cardiac catheterization have contributed to improved outcomes for children with congenital heart disease. As a result, there are increasing numbers of children and adolescents who must undergo multiple invasive cardiac procedures at various developmental stages. During these procedures, management of pain and anxiety using nonpharmacological methods is especially important, given the limitation in the types of medications that can be used and the potential for side effects with larger dosages. In addition, children may be particularly vulnerable to the stress associated with invasive medical procedures; several studies document frequent and persistent severe distress reactions after aversive hospital experiences.¹⁻⁶ Although numerous studies document the efficacy of psychological preprocedure preparation for children and adolescents,⁷⁻¹² implementation of these interventions remains inconsistent.¹³ The following guidelines, based on review of the literature and expert consensus, were developed to facilitate systematic implementation of preprocedure preparation for pediatric patients undergoing invasive cardiac procedures.

Background

Congenital heart disease affects 8 per 1000 live births, and 2 or 3 of these infants are estimated to have critical disease requiring cardiac catheterization or cardiac surgery.¹⁴ Over the past 2 decades, there have been remarkable improvements in medical and surgical treatment, including successful performance of complete repair during early infancy and staged repair for complex single-ventricle defects. Although newer treatments have resulted in significant improvements in survival, disease-related morbidity, including psychosocial

adjustment problems, remains a significant source of concern.¹⁵⁻¹⁷ Child adjustment problems have been linked with stressful hospital experiences since the early 1950s, with published reports of anger, aggression, panic, apathy, anxiety, sleep disturbances, and separation anxiety during hospitalization that persist after hospital discharge.^{1,3,18-20} Stressors for children undergoing hospitalization and/or invasive medical procedures include (1) physical harm or bodily injury resulting in discomfort, pain, mutilation, or death; (2) separation from parents and dealing with strangers in the absence of a familiar, trusted adult; (3) fear of the unknown; (4) uncertainty about limits and acceptable behavior; and (5) loss of control, autonomy, and competence.¹² Stressors that heighten parents' anxiety and may interfere with their ability to support their child include (1) concern about the possibility of physical harm or bodily injury resulting in discomfort, pain, mutilation, or death to the child; (2) alterations in the parenting role; (3) lack of information; (4) the intensive care unit (ICU) environment; and (5) postoperative changes in the child's behavior, appearance, or emotional responses.²¹⁻²⁴

Children's adjustments to chronic illness can be understood from a conceptual framework of stress and coping. Stress occurs when the relationship between a person and his/her environment is seen as taxing or threatens personal well-being.²⁵ The effects of stress are multifaceted, resulting in physiological, emotional, cognitive, behavioral, and interpersonal changes. Physiological effects reflect sympathetic activation and include elevated heart rate, respiratory rate, blood pressure, and skin temperature. Emotional responses include anger, fear, and depression. These emotions can result in cognitive changes, particularly changes in information

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This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on September 19, 2003. A single reprint is available by calling 800-242-8721 (US only) or writing the American Heart Association, Public Information, 7272 Greenville Ave, Dallas, TX 75231-4596. Ask for reprint No. 71-0270. To purchase additional reprints: up to 999 copies, call 800-611-6083 (US only) or fax 413-665-2671; 1000 or more copies, call 410-528-4121, fax 410-528-4264, or e-mail kgray@lww.com. To make photocopies for personal or educational use, call the Copyright Clearance Center, 978-750-8400.

(*Circulation*. 2003;108:2550-2564.)

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DOI: 10.1161/01.CIR.000100561.76609.64

processing that result in an overly pessimistic or hopeless outlook. Behavioral responses can include avoidance, soothing behaviors (nail biting, thumb sucking, or hypervigilance), resistance, restlessness, and/or inability to concentrate. Interpersonal changes include alterations in communication, perceptions of others, and group functioning.

Coping refers to the set of cognitive, emotional, and behavioral responses used to manage a stressful situation. Coping styles are seen in an individual's consistent use of particular strategies for managing stressors across contexts. An individual's coping style is dependent on a number of interacting factors, including problem-solving skills, social skills, social support, health and energy, beliefs, material resources, temperament, developmental level, and familial coping patterns.²⁶ Successful coping is not indicated by the absence of distress but rather by child and/or parent perception that the event, although unpleasant, is manageable.²⁷

Emotion-focused coping uses strategies aimed at regulating emotional responses to stress, whereas problem-focused coping strategies seek to alter the stressor or external circumstances. Although both children and adolescents use a variety of coping strategies, there is usually a dominant pattern of coping characterized by either approach behaviors (these individuals are classified as sensitizers) or avoidance behaviors (these individuals are classified as repressors).^{28,29} Sensitizers seek health- and/or procedure-related information, may demonstrate anxious behavior before hospitalization, and generally exhibit positive adjustments after the experience. Repressors avoid health-related information, deny stress, prefer to focus on items unrelated to the medical proceedings, and are more likely to exhibit anxious behavior after the event.^{29,30} Nevertheless, the research to date suggests that there is not a definitive one-to-one correspondence between coping style and child adjustments. The critical dimension may be the extent to which the children or adolescents have a "plan" for dealing with a procedure.²⁶ For example, behaviors associated with positive adjustments include active information seeking and exploration of medical equipment and toys but might also include "deliberate" avoidance or refocusing (distraction).^{29,31} Although inconclusive, some data suggest that interventions congruent with an individual's coping style are more efficacious.³²⁻³⁴

When confronted with stressful situations, children exhibit a variety of coping behaviors and can learn novel techniques to control their responses.^{35,36} Hospital-based preprocedure preparation programs aimed at enhancing children's ability to cope with medical procedures continue to be affected by changes in healthcare delivery models and economic constraints. Whereas in past years preprocedure preparation was initiated by the nurse or child life specialist the night before a procedure, the current practice of performing invasive procedures on an outpatient or admit-day-of-procedure basis necessitates alternative strategies. Concurrent with these changes are cost-containment issues that continue to impact resource availability.

Scope and Purpose

The purposes of these guidelines are (1) to describe evidenced-based interventions that may be beneficial for

children undergoing invasive cardiac procedures and their parents, (2) to delineate subgroups of children to target effective preprocedure preparation, and (3) to identify resources needed to implement these interventions programmatically. The guidelines pertain to children undergoing invasive cardiac procedures between the developmental ages of 3 and 18 years. In these guidelines, the term "invasive procedure" pertains primarily to diagnostic or interventional cardiac catheterization and cardiovascular surgery. During these procedures, however, there are many stress points for children, such as venipuncture, separation from parents at the time of transport to the operating room, anesthesia induction, and/or removal of chest tubes and intracardiac lines.

Methods

These guidelines and recommendations are based on comprehensive review of research literature by a panel of experts, with additional review of the proposed guidelines by expert consultants representing child psychiatry, child life, and parents. Key words used in the data search were adolescents, children, cardiac catheterization, cardiac surgery, preparatory intervention, congenital heart disease, and coping. Reference lists and bibliographies from review articles were the source for additional references.

Expected Outcomes for Preprocedure Preparation

The following expected outcomes for preprocedure preparation are viewed as inherently valuable to children with congenital heart disease, family members, and health care providers.

1. Reduced anxiety for patients and family members/caretakers
2. Improved patient cooperation and adjustments during and between medical procedures
3. Enhanced postprocedure recovery
4. Increased sense of mastery and self-control for patients and family members/caretakers
5. Enhanced trust between patients, family members/caretakers, and health care providers
6. Improved long-term emotional and behavioral adjustments in patients and family members/caretakers

Child and Family Assessment (See Appendix A)

Procedure preparation begins with assessment of the children's and parents' current level of understanding and emotional response to the planned procedure. The real, imagined, or potential threats to personal well-being are dependent on many factors, including developmental level, temperament, previous medical experiences, knowledge/information about the experience, family coping patterns, and social support. The severity of cardiac symptoms, although less important than the previously mentioned factors, may affect child and family perceptions of the risks and benefits associated with an invasive cardiac procedure.³⁷ For example, children who are asymptomatic and their parents may have a difficult time understanding the benefit to be gained by medical intervention. Identification of support systems for children and

parents/caregivers, including spiritual beliefs and practices, is important. Assessment of cultural background, including health beliefs, culturally specific health care practices, and culturally valued ways of expressing care, is also needed. Careful planning and utilization of resources is indicated for the child with special communication needs because of attention deficit disorder, deafness, visual impairments, or language barriers. Because of the dynamic effect of acute and chronic illness on families, ongoing assessment is needed.

Assessment of the child and parents/caregivers can occur in the context of either a long-standing outpatient relationship with the cardiovascular team or a newly developed relationship that is primarily procedure focused. In either situation, key areas to assess and explore with families are (1) the child's developmental level and coping style; (2) the patient's and caregivers' understanding of the medical condition and planned procedure; (3) previous hospital experiences, particularly adverse ones; (4) current emotional, cognitive, and physical symptoms and perceived health of the patient; (5) general and procedure-specific fears; (6) family composition, including language, cultural, and religious factors; (7) the method in which information is best processed by the patient and the caregivers (ie, verbal, visual, written, sensory); (8) other family stressors (ie, financial, transportation, social, and other health issues affecting family member); and (9) family/caretaker coping styles and modes of decision-making.

Key Factors Affecting Preprocedure Preparation

Child Cognitive Development

Understanding the stages of cognitive development in children is fundamental to understanding children's perceptions of health-related events and information-processing abilities. Beginning in infancy when the infant replicates a particular movement to elicit a novel response, cognitive development culminates in the abstract reasoning abilities of the adolescent. The seminal work of Piaget³⁸ continues to provide an excellent description of the development of cognitive abilities during childhood. In this model, the child selects and processes information and thus functions as an active participant in the acquisition of knowledge.³⁸ Age ranges identified reflect rough approximations only.

Sensorimotor Period (Birth to 2 Years)

During the sensorimotor period of cognitive development, the infant learns of the external world through the senses (eg, sucking) and motor actions (eg, shaking a rattle) as opposed to internal mental representations of the world. The infant develops awareness that people and things continue to exist even when out of site (object permanence). Because of limitations in children's conceptual abilities, preprocedure preparation at this developmental stage focuses on the parents/caretakers. Minimization of pain and other physiological stressors (such as duration of preprocedure fasting times) and minimization of separation from parents is of paramount importance. A transitional object, such as a blanket or stuffed animal, can be very effective in soothing the infant during times of separation from parents.

Preoperational Stage (2 to 7 Years)

The preoperational stage of cognitive development is characterized by egocentric and concrete thinking.³⁸ At this stage, children view external events as the cause of illness, cannot conceptualize internal body parts, can use symbols but have single interpretation for words, and think in absolutes (good/bad). Although they are eager to please and curious about their environment, their coping strategies and concept of time are limited, and they usually have limited attention spans. Fantasies tend to dominate, and children at this stage cannot think logically, so they learn through their senses and by trial and error. Separation from parents creates considerable anxiety.

During the preoperational stage, learning is concrete and primarily experiential, best achieved through "hands-on" play experiences. Children in this stage can generally assimilate only limited amounts of information (approximately 15 minutes) delivered the day before the procedure, although this is a general recommendation and some children may benefit from earlier exposure to preprocedure preparation.⁹ Language needs to be simple and reassuring, without use of medical terminology. Children in this age group are very concerned with body integrity, and discussion of "boobos" and "Band-Aids" figures into their understanding of invasive procedures. Picture books about "going to the hospital" and doctor play kits are excellent tools to promote the children's understanding before hospitalization as well as after discharge to process the experience. The content of children's questions indicates learning readiness as well as their misperceptions.

At this stage, children may benefit from play sessions with a trained health care provider (nurse, child life specialist, or social worker) that offer simple explanations and descriptions while allowing the child to see and handle some of the medical equipment that will be used.^{39,40} Unguided play therapy in the presence of a trained health professional or knowledgeable parent, using dolls, doctor kits, or simple hospital props (eg, surgical hats/masks, syringes [without needles], chest tubes, stethoscopes), gives the child a way to express anxiety, process information, and become familiar with equipment that will be used during their hospitalization. Play sessions may be particularly beneficial for children with previous medical experiences. Refocusing techniques (distraction methods) can also be very effective in helping young children manage anxiety and can be used throughout the hospital experience. Examples include providing entertainment videotapes (eg, favorite cartoon characters), play (eg, blowing bubbles), fantasy, and entertaining conversation with parents or trusted caregivers.

During the procedure, young children's fears of mutilation and separation may prompt reaching out for emotional support: someone to hold their hand, stroke their forehead, or listen attentively to them.^{41,42} A familiar toy, stuffed animal, or blanket provides comfort for the young child. Limiting the time that a child is separated from trusted caregivers is of critical importance for children and parents and should be reflected in hospital visitation policies. Parents' ongoing presence and active participation in the child's care should be encouraged and supported.

Concrete Operational Period (7 to 11 Years)

During the concrete operational stage of cognitive development, children develop increased abilities to think logically, as evidenced by a rudimentary understanding of cause and effect.⁴⁰ Children in this stage can view a situation from more than one point of view, can generalize from one experience to another, and have a concept of past and future. They have improved language and neuromuscular skills and seek to master situations. They have an increased awareness of internal body parts and body functions, and they fear loss of body parts, disability, and loss of control. Separation from parents tends to be less of an issue in this age group, and peers start to gain importance.

School-age children respond optimally when the information is presented approximately 1 week before surgery.⁴³ This is a general recommendation, and children at the older end of this age category may benefit from earlier exposure to preprocedure preparation (ie, 2 to 4 weeks). Children's questions and behavioral adjustments provide cues regarding appropriate timing for information given before an invasive procedure. Again, the terminology and language must be chosen carefully to prevent misunderstanding and unnecessary stress. Children at this age can understand that the heart is a pump and that it pumps blood to all parts of the body. They can also understand that sometimes the heart does not work as well as it should, but the doctor can do an operation so that it will work better. Hospital tours and "preop" classes are often helpful, although exposure to stressful hospital sights is generally avoided.

Formal Operational Period (12 to 15 Years)

During the formal operational period of cognitive development, abstract thinking begins, and adolescents can fully understand how the heart functions, the nature of the problem, and the reason for an invasive medical procedure. Common fears include fear of waking during the procedure, pain, and the possibility of death prompting questions such as "If they mess up, can I die?" "If I am feeling a lot of pain, does that mean I am dying?" and "How badly will it hurt?" Given the adolescent's heightened concern about body image, the location and extent of surgical scars often becomes a greater concern. This is a time when independence from parents evolves, and body image and peer groups are extremely important. Peer counseling, either arranged through health care providers or online (see Peer Modeling and Peer Counseling) is often well received. Adolescents with or without previous medical experience may benefit from viewing peer-modeling videotapes.⁴⁴

Finally, children and adolescents with previously diagnosed emotional or behavioral problems and/or who demonstrate disabling levels of anxiety may benefit from consultation with a mental health clinician (eg, psychologist, social worker, child life specialist, or child psychiatrist). The goal of consultation is to develop a treatment plan in conjunction with the child and parents/caregivers before hospitalization. The treatment plan should include individualization of the preprocedure preparation process with guidelines for staff interactions that address alteration in medications before, during, and after surgery; hospital room placement; primary

nursing assignment; and/or (if indicated) in-hospital intervention by a mental health clinician.

Previous Hospital Experiences

Previous hospital experiences play an important role in determining child and adolescent responses to invasive medical procedures, particularly when those experiences are perceived negatively.^{45,46} Studies suggest that naive children demonstrate decreased anxiety after viewing hospital-relevant audiovisual materials, whereas children with previous hospital experiences may have increased levels of anxiety or remain unaffected.^{44,47} These findings can be explained by a conditioned anxiety reaction that may be amenable to behavioral counterconditioning.⁴⁸ Sensitization to audiovisual materials for children with previous hospital experiences is increased in younger children and seems to decrease with age, so that adolescents, with or without previous hospitalizations, may benefit from use of these materials.⁴⁴ Experts conclude that experienced children may benefit most from preparation that includes not only procedural information but also instruction about coping techniques such as relaxation techniques, guided imagery, and conscious breathing techniques.^{7,9,49}

Timing

The timing of preprocedure preparation is another important factor to consider. In younger children (age 3 to 5 years), anxiety levels are managed most effectively with preparation the night before surgery, whereas older children (age 5 to 12 years) respond optimally when the information is presented 1 week before surgery.⁴⁶ Preprocedure interventions attempted within 24 hours of surgery may actually increase school-age children's anxiety levels.^{46,47} When only limited preparation time is available, refocusing techniques or distraction may be more effective than other methods.

Although optimum timing for preparing parents before child hospitalization has received less attention, Ferguson⁵⁰ found that a preadmission home visit decreased maternal anxiety and increased satisfaction with care. Also, preparatory materials sent to the home (ie, written information for families and medical play items such as surgical masks) were as effective as in-hospital preparation by nurses in decreasing parents' and children's stress reactions.⁵

Temperament and Coping Style

Child temperament refers to relatively stable qualities of reactivity and self-regulation in response to environmental stimuli that are assumed to have a constitutional basis.⁵¹ Temperament is considered central to personality and reflects characteristics including activity level, response to novel situations, general mood, distractibility, intensity of reaction to stimuli, and attention span.⁵² Considerable overlap exists between temperament and children's coping styles, particularly with regard to categorization of children's tendencies toward approach or avoidance in response to aversive medical procedures.³³

A characteristic of temperament labeled self-regulation has particular relevance for guiding the preprocedure preparation process. The child's ability to self-regulate behavior reflects

processes that modulate (increase or decrease) reactivity via attention focusing and inhibitory control.⁵³ This characteristic can be observed as early as 10 to 12 months of age, with ongoing development and refinement seen throughout childhood. Self-regulation is associated with decreased fear, positive affect, and reduced frustration levels in young children^{51,54} and with effective coping during medical procedures.⁵⁵ Further work on the interaction of child temperament and coping offers much promise for guiding the development of individualized preprocedure preparation interventions.

Role of Parents

Parental participation is integral to the preprocedure preparation process, starting with parental agreement to their child's involvement.²⁴ Children's adjustments reflect a mutual and richly dynamic interplay of child-parent environmental factors over time. Therefore, goals for procedure preparation include addressing parental concerns and needs so that parents can be more emotionally available to their children. Before cardiac procedures, parents demonstrate significant levels of psychological stress and diminished coping abilities whether heart catheterization or heart surgery is planned.⁵⁶ Parents may verbalize their fears directly or engage in behaviors that appear to communicate anxiety, such as agitation and apology.^{57,58} Parental behaviors that enhance children's coping abilities include engaging in humorous conversation, talking about topics unrelated to the procedure, and promoting the child's use of coping skills. Conversely, parental criticism, anxiety, and excessive verbal reassurance can increase children's stress.^{55,57,59,60} Interventions aimed at addressing parental concerns regarding children's hospitalizations have been effective in decreasing parental anxiety and enhancing child behavioral outcomes.^{8,50}

Active parental participation in the preprocedure process also enhances the efficacy of a variety of preprocedure preparation methods, including preprocedure class, peer-modeling videotapes, or brief explanations by nurses.^{49,61,62} Parent education regarding the sequence of events, sensory experiences, role expectations, typical child responses, and previews of procedures through play techniques decreases stress-related behaviors in children undergoing heart catheterization⁸ and surgery.^{9,63}

Parents can provide positive reinforcement for coping strategies, act as supportive role models, and may function as "coaches" for cognitive behavioral interventions, such as relaxation exercises.^{7,8} Thus, engagement of parents in the preparation process is effective and offers practical benefits that are particularly important given the limitations of available preparation resources. Interventions aimed at facilitating parental coping are anticipated to be of particular importance for younger children (ie, preschoolers) because of their limited ability to use internal coping strategies.^{8,50}

Methods for Procedure Preparation (See Appendices B and C)

Research regarding the efficacy of procedure preparation generally indicates that outcomes are enhanced by (1) active participation by children and family member/caregivers; (2)

personal interaction with health professionals (compared with only watching a videotape or reading a pamphlet); (3) developmentally appropriate timing and content; and (4) comprehensive stress management programs that provide information, supportive counseling, and coping-skills training. Issues about intensity, rehearsal, reinforcement, and timing require further investigation.¹⁰ Because of the prolonged time periods and intensity of the procedures involved, many of the interventions must integrate cognitive-behavioral methods with pharmacological therapies for pain and/or anxiety.^{10,64,65}

Information Giving

Early studies document the efficacy of providing information about anticipated medical procedures, and this continues to provide the foundation for most hospital preparation programs. The goals of information giving are to promote a sense of mastery by enabling the child/parent to anticipate events, to facilitate child and parent understanding of the meaning/purpose of these events, and to correct misinformation. Information giving is congruent with information seeking as a dominant coping strategy for both adults and children^{41,66} and is enhanced by the provision of sensory descriptions.^{67,68} It is important to remember that some parents and children cope by avoidance and may experience increased anxiety when health information is provided. Although certain information may be deemed necessary, refocusing may be the most effective intervention for these individuals.³²

Information can be provided by a variety of methods, including (1) verbal discussions with the physician, nurse, child life specialist, and other health care team members; (2) videotapes of a hospitalization or procedure; (3) written information or picture books; (4) preoperative classes; (5) hospital tours; (6) structured-play sessions or puppet shows; and/or (7) via computer/Internet. It is important to remember that information processing is affected by multiple factors, including anxiety and developmental/cognitive level; thus, ongoing validation of the child's and parents' understanding is needed.

Verbal information should be simple, realistic, and honest. When communicating with children, it is necessary to provide concrete information using child-sensitive language and avoid words that can be threatening or misinterpreted (eg, "make an opening" instead of "cut" and "remove the chest tube" instead of "pull the chest tube").

The majority of pediatric hospitals that provide surgery (83.9%) and special procedures (73.9%) provide written material to families.¹³ Written materials can be adult or child-directed and are generally enhanced by visual images or diagrams. Although many families and children now use the Internet for medical information, the information may be inaccurate, so health providers need to guide families toward reputable sites.⁶⁹

Preoperative classes that provide opportunities for active participation have proved beneficial in decreasing children's anxiety.⁷⁰ Expert recommendations for hospital classes include small group size; short time periods (30 minutes or less if the child demonstrates anxiety or stress); parental participation; indirect methods such as films, slide shows, or puppet

shows; limited exposure or discussions on painful or threatening events; and time allotted for answering questions.⁷¹ Although hospital tours are frequently provided, there are no data regarding effectiveness.¹³ Tours should include "child-safe" areas such as the play room and may be enhanced by meeting staff members who will be involved in the child's care.

Cognitive Behavioral Interventions

Cognitive behavioral interventions involve teaching the child or adolescent coping skills or methods they can use to help manage stress or anxiety. These techniques help the child to anticipate, recognize, and more effectively manage distressing physiological, behavioral, emotional, and cognitive responses to stressful circumstances. Numerous studies document increased efficacy when preprocedure preparation includes training in cognitive-behavioral interventions,^{7,49,72} particularly for children and adolescents with previous medical experience.^{45,73,74} The therapeutic effects achieved by use of cognitive behavioral interventions have been attributed to a variety of cognitive and physiological responses, including decreased pain secondary to muscle relaxation, habituation of body sensations, distraction, altered perception of the event, increased positive reinforcement from self and others, and enhanced sense of mastery or internal locus of control. Interventions include guided imagery, positive self-instruction, progressive muscle relaxation and conscious breathing. Most studies incorporate a variety of these interventions, providing the child with a repertoire of strategies from which to choose. The skills are usually taught by a mental health clinician (or trained health care provider) during sessions typically lasting 45 minutes. Active rehearsal before the procedure is usually needed, and effectiveness may require the presence of a "coach" during the procedure.^{73,75} There are no compelling data comparing the efficacy of the individual interventions.

During guided imagery, the child learns to focus on a positive, relaxing scene during times of stress. Trained personnel meet with the child before the procedure to develop the imagery and to practice the intervention. Active coaching during the actual procedure is usually needed, and this is a role that parents may be trained to assume.⁷ Although guided imagery has proved beneficial in decreasing emotional and behavioral distress during bone marrow aspiration and lumbar puncture in children with cancer,⁷⁶ when used alone, it has not proved effective in decreasing anxiety for children undergoing heart catheterization.^{42,77} This may be because of the relatively long duration of the procedure, because relaxation achieved by guided imagery usually cannot be sustained in children longer than 15 to 20 minutes.⁴²

Other cognitive-behavioral interventions include positive self-talk, progressive muscle relaxation, and conscious breathing exercises. Positive self-talk involves teaching the child to tell himself or herself encouraging information. Progressive muscle relaxation involves teaching the child to use cue words to consciously relax various muscle groups until total body relaxation can be achieved. Conscious breathing involves teaching the child controlled breathing techniques with slow, deep inhalation via abdominal muscles and

slow, controlled exhalation.⁷⁸ As described previously, stress-management programs that use a variety of these techniques and provide education and rehearsal have been most effective.

Biofeedback

Biofeedback facilitates conscious relaxation and control of physiological processes through feedback most often provided by physiological monitoring equipment. The child is taught a method of relaxation and then provided data regarding pertinent parameters, such as heart rate and skin temperature, that indicate sympathetic stimulation. Relaxation augmented by electromyographic biofeedback has been used successfully in a comprehensive stress-management program in children undergoing cardiac catheterization.⁷ Although there are minimal data assessing the efficacy of biofeedback for children undergoing cardiac procedures, there are considerable data regarding the efficacy of these techniques in the pediatric population.⁷⁹ Advantages in children include high acceptance (most children seem interested in the equipment used) and a lack of resistance or skepticism that may be a problem when working with adult patients. Disadvantages include the time and resources required, because the method requires a trained therapist and specialized equipment. A training period of 6 weeks may be needed to achieve optimal results.³⁶

Refocusing (Distraction) Techniques

Refocusing is a powerful cognitive behavioral intervention for children that involves the conscious redirection of the child's attention from stressful stimuli to relaxing or entertaining stimuli. It may be visual or auditory and can be achieved with films or videos, cartoons, posters, bubbles, movement toys, "I Spy" books, video games, or audio tapes (eg, nursery rhymes, music, or relaxation tapes) as well as engaging in conversation. Audio tape distraction has proved beneficial for infants undergoing cardiac catheterization, with mixed results for older children.⁸⁰ Audio tapes were also found to be effective in decreasing self-reported pain for children age 4 to 6 years undergoing injection.⁸¹ Video game distraction has been shown to decrease distress and nausea related to chemotherapy treatments and to facilitate positive child and parent coping with childhood immunizations.^{82,83} Waiting and procedure areas that are child friendly and equipped with toys, games, and other compelling activities represent "built-in" refocusing opportunities that decrease stress considerably during the long waiting periods that often accompany hospital visits. For hospitalized children, the importance of easily accessible and professionally supervised activity rooms providing age-appropriate activities cannot be overemphasized.

Play Therapy

Play is a primary form of communication for younger children and provides an effective method for the presentation and exploration of medical concepts while permitting insight into the child's understanding of the situation and level of coping. Play can be spontaneous or recreational, expressive or therapeutic. Spontaneous or recreational play is

play activity in which the child chooses the items and activities, and it can provide distraction from stressful circumstances. Expressive play provides a means for expression of feelings, release of energy, and relaxation. Medical play combines spontaneous and therapeutic play to prepare children for medical or nursing procedures through the use of hospital-related "props" such as syringes, masks, and dolls with intravenous lines, incisions, and chest tubes. These items are used to convey information and give children opportunities for "hands-on" learning. During the play session, concrete simple explanations can be offered, and misperceptions can be corrected.^{39,84} Medical play using a beloved doll or stuffed animal often works well, because it allows the child to be in a position of control as the doctor or nurse and play/act accordingly. Medical play sessions offer an ideal opportunity for assessment of children's current level of coping, medical information, and areas of misperceptions. This technique involves directed play and thus requires the involvement of a trained health care provider such as a nurse, child social worker, or child life specialist.

Peer Modeling and Peer Counseling

The effectiveness of peer modeling in conveying information and reducing anxiety associated with medical procedures for naive children has been well documented.^{50,85–87} This technique is based on social learning theory⁸⁸ and aims to facilitate learning by exposing children, via film, videotape, photographs, or written materials, to a model who copes with similar circumstance in a positive manner and/or with positive outcomes. Through the model, anticipated emotions can be conveyed and thus normalized, effective coping demonstrated, and information given about the sequence of events and anticipated sensations. Use of peer modeling in children with previous medical experience is less effective and may even have a detrimental effect.^{44,47,89,90} Peer modeling may be more effective if active rehearsal is encouraged.⁷⁵ Institution-specific tapes have not been found to be more effective than generic videotapes.⁹¹

Child-to-child and parent-to-parent peer counseling consists of either formal or informal contact between individuals with similar cultural backgrounds, diagnostic categories, ages/developmental stages, or coping styles. Peer counseling is a natural outcome of relationships developed at specialized children's camps, support groups, or through interactions on the Internet. Although the effects of this approach to preprocedure preparation have not been well studied, there are data supporting the positive effects of supportive interactions with others facing similar health challenges.⁹²

Before procedures, such encounters may be initiated at the request of the child or family member or suggested by a health care provider who then arranges the interaction. Issues to be addressed include the protection of privacy for both parties and limitation of discussions to overall experience or events, with referral of specific medical questions to the nursing/medical team. It is important for nursing, social service, and medical staff to remain available for clarification, education, and support.

Pharmacological Therapy

The use of an anti-anxiety agent the night before an invasive procedure or an oral premedication can be useful. The prototypical situation is when an anxious child must undergo an acute procedure, such that the time frame precludes nonpharmacological intervention. Lorazepam in a dosage range of 0.02 to 0.09 mg/kg has been found to produce adequate anxiolysis for children facing medical interventions.⁹³ The most common untoward effects are the manifestations of central nervous system depression (ie, fatigue, drowsiness, ataxia, and confusion). Although rare, "paradoxical reactions" or episodes of marked disinhibition and increased anxiety have been reported in some children.⁹⁴

Personnel: Training and Roles/Resources

Invasive cardiac procedures are complex, generally requiring a diverse team of health care providers (with diverse educational backgrounds) including physicians, nurses, and technicians across several patient care units (eg, clinic, catheterization laboratory, recovery room, and inpatient units). Therefore, ongoing education for all of these providers, aimed at increasing awareness of and sensitivity to the needs of children and families, is recommended. Educational issues to be addressed include child developmental stages, use and importance of child-sensitive language, children's coping methods, parental coping methods, and use of appropriate interventions during stress points (eg, refocusing techniques).

Pediatric Cardiologist and Primary Care Physician

The doctor-family relationship is integral to the preprocedure process and outcomes. Primary care physicians are usually involved in the initial diagnostic and referral process and frequently provide initial information and support to the family. They also have a significant role in the follow-up care of the child and family.

The family's relationship with their child's pediatric cardiologist and cardiovascular surgeon is paramount. Communication with these specialists provides the foundation for understanding the diagnosis, prognosis, and treatment options, including the need for invasive procedures. These physicians are also the leaders of the health care team and are thus in a pivotal position to foster a team approach that incorporates and values preprocedure preparation programs.

Advanced Practice Nurses (Clinical Nurse Specialist, Pediatric Nurse Practitioner, Nurse Clinician)

Advanced practice nurses (APNs) who are specialty or unit based can assist in the preparation of children for invasive procedures. These individuals usually hold a master's degree and are prepared with an educational background in pathophysiology, child and family assessment, child psychology, and child and family adjustments to chronic illness. Interactions with the child and family before the procedure may have facilitated the development of a trusting relationship between the APN and the child and family. APNs are well positioned to provide preprocedure preparation because of their focus on psychosocial adjustment, disease management, and provision of continuity of care. As a result, they can facilitate a detailed

understanding of the pathophysiology of the defect, surgical interventions, and anticipated recovery and potential issues (eg, morbidity, activity restrictions, school restrictions) and offer anticipatory guidance (eg, nutrition, developmental response to events).

Pediatric Nurses

Historically, pediatric nurses provided preprocedure preparation during hospitalization the night before the procedure, although this role has been curtailed by the transition to same-day procedures. Pediatric nurses continue to be instrumental in providing procedure preparation for hospitalized children and provide these services in outpatient clinics and office settings as well.

Child Life Specialists

Child life specialists are health professionals who focus on enhancing the normal growth and development of children and families dealing with health-related issues. They have a bachelor's degree with course work in child development, child and family psychology, and early childhood education. Goals of the child life specialist include (1) providing play experiences, (2) providing psychological preparation for children by presenting developmentally appropriate information about health care–related events and procedures, and (3) establishing therapeutic relationships with children and parents to support family involvement in each child's care.⁹⁵ Play in all its forms is a key modality used, and child life specialists provide needed expertise in medical play for children undergoing invasive medical procedures. They can assist in desensitization procedures for young children and medical play and recommend referral to a psychologist or other team member if indicated. In addition, they can provide a sense of normalcy through provision of routine, structure, and developmentally appropriate activities during hospitalization.

Social Workers

Social workers are integral to most pediatric cardiology programs, offering much-needed expertise regarding the impact of chronic illness on children and families. The role of the medical social worker is diverse and includes comprehensive child and family assessment, psychosocial support, counseling, stress management, crisis intervention, education, advocacy, and helping families meet tangible needs. They facilitate ongoing support and intervention via identification of available community resources with referral as needed. Most social workers in a medical setting are prepared at the master's level (MSW).

Child and Adolescent Psychiatrist, Pediatric Psychologist, Behavioral Pediatrician

Unfortunately, most pediatric cardiology centers have limited access to these highly trained specialists, but they may be able to use their services on a referral or consultation basis. Indications for referral include child or parental depression, incapacitating anxiety or fear, end-of-life decisions, persistent behavioral adjustment problems, prolonged hospitalization, and/or ineffective coping mechanisms. Consultation with

these specialists in the development and/or review of new educational materials and the content of the overall procedure-preparation program is highly desirable.

Preparation for Cardiac Procedures

Preprocedure preparation depends, in part, on whether cardiac catheterization or cardiac surgery is planned. Although it has proved efficacious in both situations and there are similarities in the stressors encountered, there are also significant differences. Both types of procedures are viewed as serious events and cause considerable stress for parents and children.⁵⁶ In both cases, given limitations in the type of medications that can be used and the potential for side effects with larger dosages, nonpharmacological management of pain and anxiety is important. Many similar stress points are also encountered, including separation from parents, venipuncture, and dealing with strangers in the absence of a trusted adult. Finally, there are overlapping educational issues, including the diagnosis, treatment options, and prognosis.

There are also differences between the 2 experiences that affect preprocedure preparation. Heart catheterizations are often performed under conscious sedation, whereas surgery necessitates anesthesia induction. Furthermore, whereas heart catheterizations can usually be done on an outpatient basis, heart surgery usually requires an extended hospital stay. Pain management, anesthesia induction, scars/incisions, and ICU preparation are key areas of concern for the child scheduled for heart surgery. The following paragraphs examine preprocedure preparation specific to cardiac catheterization and cardiac surgery.

Cardiac Catheterization

Cardiac catheterization is a stressful experience that is associated with a high incidence of child behavioral changes, including aggression, separation issues, regression, and anxiety, with more severe effects observed in younger children.¹ Challenges facing health care professionals caring for these patients include increased numbers of children who are undergoing interventional cardiac procedures such as transcatheter atrial septal defect closure, coil occlusion of patent ductus arteriosus, balloon valvuloplasty or angioplasty, and radiofrequency ablation for tachyarrhythmias. These procedures can take as long as 3 to 5 hours and are often performed under conscious sedation, because anesthesia may alter the cardiovascular hemodynamics. Pain and anxiety may not only confound clinical data (blood pressure, cardiac rhythm) but also manifest as distress or lack of cooperation by the child, impeding the success and timely completion of the catheterization procedure.⁴² Goals of premedication and sedation (or anesthesia) are to decrease anxiety, ensure patient comfort during the procedure, promote amnesia, and facilitate the performance of the procedure so that it may be undertaken as safely as possible.⁹⁶

The child's response to the stress of cardiac catheterization will be influenced by the child's age or developmental stage, the child's perceptions and appraisal or fears, the child's coping skills, and the parents' anxiety.^{1,40,89} Preschool children may fear mutilation and abandonment or separation

from parents, whereas older children fear loss of control, invasion of privacy, and bodily harm and/or death. The child's perceptions may be based on his or her own previous experience with invasive procedures, but even the inexperienced child may have misperceptions based on adult reports of their cardiac catheterization experience and, more frequently, on the child's television experiences. The cardiac catheterization laboratory resembles an operating room (masked physicians, monitors, and emergency equipment), a sight familiar to many children via television viewing. Stressors and fears need to be explored so that misconceptions or distorted fantasies can be corrected. Assessment of the child's past coping behaviors may also help tailor the intervention strategy to the child's preferred coping style¹⁰ or suggest other more effective techniques.

Information Giving/Sensory Experiences

Information about the procedure and validation of the child's understanding is needed, because many children demonstrate lack of understanding and/or misperceptions about cardiac catheterization.⁶⁵ In addition to an age-appropriate explanation of the procedure, anticipatory guidance about sensory experiences including the appearance of equipment in the cardiac catheterization room, personnel wearing masks, use of cardiac electrodes, restraints on the child's arms, sterile sheets and towels covering the child, and the sounds of monitors beeping and other equipment noises should be provided. Children can be counseled that during the procedure they will generally feel sleepy but may feel the catheter insertion site being cleaned with a cold liquid (Betadine), the pinching or discomfort of the lidocaine injections, and a warm feeling after contrast injection. If general anesthesia is used, sensory information about anesthesia induction may be beneficial. After the procedure, the children need to know that they are usually required to lie flat for 4 to 6 hours. Older school-age children need assurance regarding respect for their modesty and privacy issues.

The method of presentation of medical content is an important consideration. In one of the earliest studies, Cassell⁴⁰ showed a positive effect on children's behavioral stress through information delivered to children via a puppet show. Other methods of information giving include booklets, videotapes, structured medical play, and/or tours of the catheterization laboratory as well as verbal communication with health professionals.

Cognitive Behavioral Interventions Before Cardiac Catheterization

Refocusing techniques have proved effective for children at various developmental stages, irrespective of whether they have previous experience with heart catheterization. School-age children undergoing cardiac catheterization are generally eager to listen to audio tapes and are highly distractible.⁸⁰ Older adolescents also report that using refocusing techniques, such as listening to music, can be helpful.⁶⁵ Children and adolescents may perceive increased control over their environment by being given a choice of their favorite music tapes or compact disks and available relaxation tapes.

Comprehensive coping-skills training has been shown to be effective in children undergoing cardiac catheterization. Campbell et al⁷ describe a comprehensive stress management program including counseling and coping-skills training (controlled breathing, progressive muscle relaxation, biofeedback, guided imagery, and cognitive reframing), which was associated with a positive effect on children's stress-related behaviors both during and after hospitalization. Parental satisfaction with care and parents' ratings of children's behavior after discharge were also more favorable in the experimental group. A similar program targeting mothers of preschool children undergoing heart catheterization was effective in decreasing maternal anxiety and child stress-related behaviors.⁸ Guided imagery, when used in isolation, has not proved effective for this younger population,^{42,77} perhaps because it is difficult to sustain for long periods of time. Other studies have also found that distress-reduction effects did not persist when the therapist (coach) was not present,^{73,74} making this strategy less feasible if adequate personnel are not available.

Parent Involvement

Assessment of parental anxiety and stress levels is important, because both contribute to child stress. Information given to parents, as with children, should be individualized on the basis of their cultural and intellectual background, their previous hospital experience and knowledge, and their emotional needs. It is important to provide accurate information and to correct misconceptions that are often related to the experiences of adult family members and friends who have undergone heart catheterization. Parents need information about what to expect during the child's hospital stay, their own roles, and how to support their child.

Cardiac Surgery

Although there have been dramatic improvements in morbidity and mortality, heart surgery is a major surgical procedure that imposes multiple stressors on children, adolescents, and their parents. Children and families must cope with anesthesia induction, monitoring in an ICU, multiple medical procedures, and a period of recovery in a hospital ward with continued monitoring and increasing activity. Most patients will experience venipuncture, intravenous lines, chest x-rays, taking of vital signs, cardiac monitoring, incisions/scars, bandages/dressings, chest tube removal, and taking of medications.

In addition to the physiological sequelae of surgery and recovery, there are emotional stressors including a surgical procedure 2 to 5 hours long or more, separation from parents, bodily pain and harm, loss of control, and fear of the unknown. Because the heart is a vital organ, fear of a life-threatening event is often present. Overall, the literature suggests that younger children express concern about pain, needles, and strangers and are less likely to identify fear of dying or general anesthesia,^{11,97} whereas adolescents and parents have more concerns about these latter issues.

Most of the research on the stress of surgery and hospitalization has been done in children having minor surgical procedures, with relatively few studies of children undergo-

ing major surgery, such as cardiac surgery. It seems likely that cardiac surgery, with the need for intensive care, several days or more in the hospital, and multiple medical procedures, would cause more anxiety and have a greater potential for negative behavioral responses than minor surgical procedures⁸ and warrant an even greater need for preprocedure preparation.

Information Giving/Sensory Experiences

Many members of the health care team have roles in preparing children and their parents for heart surgery. Initial discussions usually begin with the cardiologist at the time surgery is recommended. Printed materials (booklets, letters, brochures) with information about heart surgery, the hospital and the ICU, and resources for families are often sent from the surgeon's office when a surgical date is set. The surgeon meets with the parents to review the risks and benefits of surgery so that informed consent can be obtained. Parents should be counseled that unexpected complications can occur requiring medical management that was not discussed before surgery. Older school-age children and adolescents may benefit from participation in selected aspects of these discussions on the basis of their maturity and interest.

Parents often need guidance about what to tell the child before coming to the hospital. For preschool children, a brief explanation given the day before the procedure is appropriate (eg, "We will be going to the hospital and staying a few days. The doctor will do an operation to help your heart work better."). Most older children will already have some awareness that they have a heart problem, thus providing the basis for a conversation about the need for an invasive procedure. Preprocedure preparation is usually most effective for this age group if initiated at least 1 week before hospitalization. The child life specialist can provide further individualized medical play to facilitate the child's understanding and sense of self-mastery.

Many topics need to be reviewed before cardiac surgery. Parents, in particular, need information regarding preoperative testing and routines, anesthesia, and the operation itself. Information should be specific to the planned surgical repair, because many aspects of postoperative care will vary among patients such as length of intubation, use of monitoring equipment, surgical incision, and expected stay in the ICU. A tour of the hospital, including a hospital room, the playrooms, and other common areas, is often helpful for parents.

In the literature, there are discussions of the content to include in ICU preparation,^{24,98,99} but there are no research data on either child responses to ICU preparation, appropriate level of detail to communicate to the child, or the efficacy of various preparation strategies. It is important to note that preprocedure information and exposure to the ICU environment may actually increase anxiety in some children, particularly younger children, those with previous hospital experiences, and those who are highly anxious.^{18,44} Topics relevant to preparation for the ICU include the environment, equipment, and the personnel the child will encounter. Many patients are sedated and receive intravenous pain medication

in the first 12 to 24 hours after surgery and will experience minimal recall regarding equipment or events during this time. Early extubation (in the operating room or within several hours after surgery) is common in many institutions, so children may have minimal recall of being intubated. The child's sensory experience of being in the ICU environment may include sights (monitors, bright lights, many people, equipment), sounds (beeping machines, voices), and sensations (feeling sore, lines and dressings, feeling thirsty).

Important recovery-related topics include the benefits of early ambulation (sitting up, walking in the hall, going to the playroom even when you're sore because it helps the body heal), coughing and deep breathing (with practice using a spirometer), and when usual activities such as school, gym class, and sports may be resumed.

Cognitive Behavioral Interventions Before Cardiac Surgery

Information giving in conjunction with coping-skills training has proved effective in children undergoing cardiac surgery. Campbell et al⁹ compared 2 methods of preparing children (ages 4 to 12 years) for heart surgery and found better in-hospital and postdischarge adjustment in children who received coping-skills training than in children who received information only as routinely provided. Children who had received coping-skills training showed less behavioral distress during hospitalization and, after discharge, better school performance and earlier improvement in functional health status. Parents also expressed greater confidence in the care-giving role both during hospitalization and after discharge. The experimental group (both children and parents) received both problem-focused and emotion-focused coping-skills training, including conscious breathing, progressive muscle relaxation, and guided imagery.

Because children will be exposed to many aversive procedures during their hospital stay, learning simple coping strategies such as refocusing via counting, singing, or blowing during stressful events is helpful. Favorite stories or a video after a stressful event may help a child relax. Bringing a favorite toy or other transitional object can be very reassuring to the child.

Parental Involvement

Parents must cope with their own fears and anxieties while maintaining their parenting role in an unfamiliar environment. Cardiac surgery and postoperative recovery in the hospital are stressful for parents, especially mothers,^{56,100} irrespective of the complexity of the surgery needed.⁵⁶ Parents may feel guilty about the child's needing surgery and feel responsible for putting them through the stress of the procedure. They are often anxious about complications and long-term outcomes.

Although most preparation programs are aimed at children, parents also benefit from the interventions, feeling better able to support their child in the hospital.^{5,72} Parents should have an opportunity to ask sensitive questions without the child present and should be made aware of social work and other available support systems. Reassurance should be given to the parents that they will remain near the child, that they will be

encouraged to stay with the child whenever possible (subject to reasonable hospital restrictions), that staff will be supportive of their family's needs, and that the child's pain will be well controlled. Anticipatory guidance regarding the child's appearance after surgery as well as the impact of hospital experiences on children's behavior (overt resistance, passive or regressive responses), both during and after discharge, is also needed.

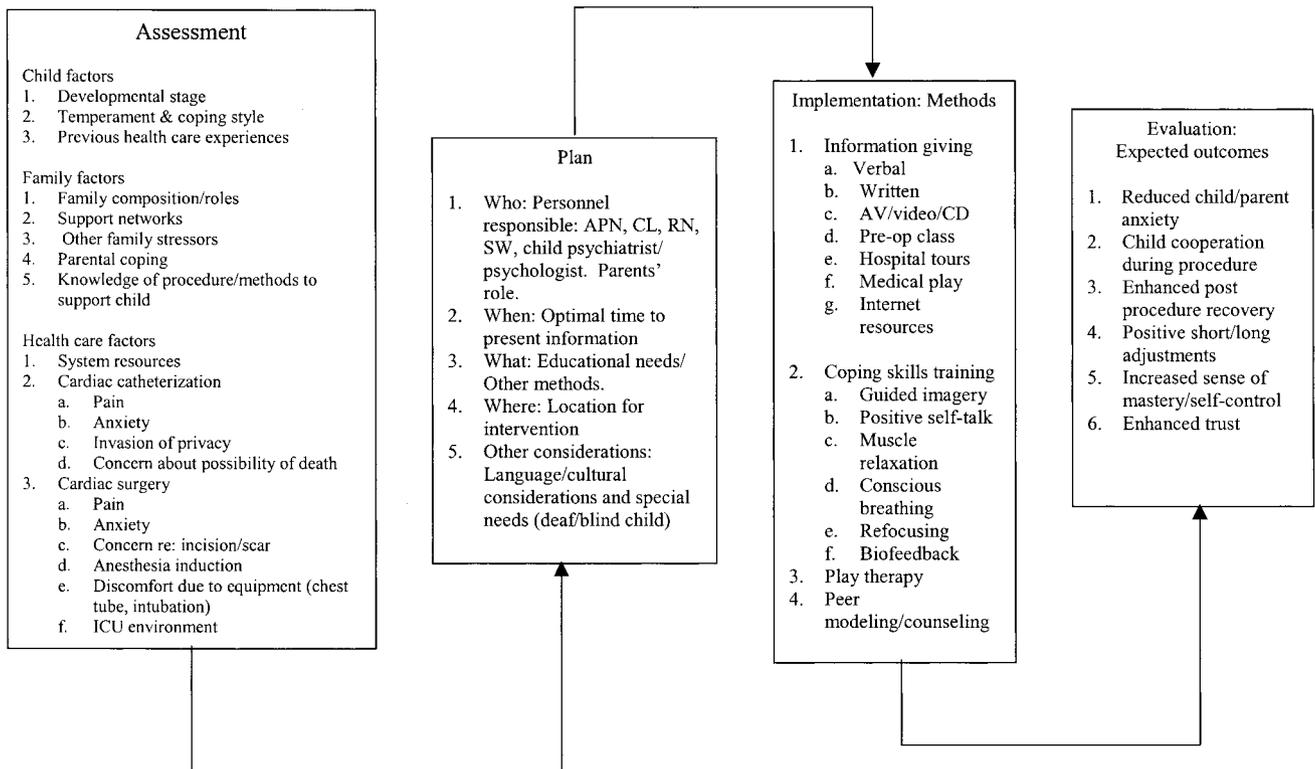
Parents have a critical role in providing emotional support to their child and should be prepared and encouraged to participate in normal parenting routines (such as feeding, bathing, playing, reading stories, cuddling) while the child is hospitalized. Rooming-in should be encouraged when possible, especially for younger children, to reduce the stress of separation. Parents can learn to support their children by coaching them through procedures using refocusing and relaxation techniques.^{8,9}

Conclusions

Significant advances in the treatment of cardiovascular diseases in the young have greatly expanded the therapeutic options available to children and families. These therapies often require invasive medical procedures, and some involve a staged approach with numerous surgical procedures and/or heart catheterizations during childhood. A significant body of scientific literature supports the efficacy of psychological preparation for this population, but implementation of this knowledge requires an ongoing commitment to a systematic preprocedure preparation program that optimally involves many different patient care units. We hope that these guidelines will facilitate the development, implementation, and evaluation of preprocedure programs for children and adolescents who must undergo invasive cardiac procedures.

Appendix A

Guidelines for Preparing Children ≥3 Years Old for Invasive Cardiac Procedures



Appendix B
Interventions for Preparing Children Before Cardiac Catheterization or Cardiac Surgery*

Intervention	Description	Benefits	Limitations	Resources/Level of Expertise Required	Level of Supporting Evidence†
Information giving: verbal	Verbal description of the rationale for procedure and what to expect. Enhanced by descriptions of anticipated sensory experiences.	Consistent with information seeking as a dominant coping method. Permits individualization of information given. Promotes trust between child/family member and caregiver. Enhances efficacy of self-directed teaching materials (e.g. written, audiovisual)	Processing of information affected by emotional responses to stress. Difficult to achieve consistency in information given. Relies on family's memory/perception of information given. If sole intervention used, may increase anxiety in children with previous experience	Involves all health team members. Requires understanding of developmental level and knowledge of age-appropriate language.	B
Information giving: written	Written materials about the procedure/what to expect/anticipatory guidance regarding child/family responses/ways to promote positive coping/available resources	Efficient way to ensure consistent and complete transmission of important information. Available to family for later reference	Availability of appropriate materials. Relies on reading abilities/habits of child/family. Difficult/expensive to individualize information given.	Availability of appropriate written materials specific to procedure, hospital setting	B
Information giving: hospital tours and preoperative classes	Preoperative classes: scheduled group classes aimed at providing basic information about what to expect. Tours: may be group or family-based tour of hospital unit(s)	Effective means to present sensory information: sights/sounds/tactile experiences. Permits play experiences with medical "props."	Requires travel to referral center before procedure. Scheduling issues. Difficult to individualize information given.	Hospital personnel trained in preprocedure preparation goals/methods	B (preop classes) C (hospital tours)
Coping skills training: progressive muscle relaxation, guided imagery, conscious breathing, positive self-talk	Cognitive-behavioral skills aimed at promoting relaxation, self-mastery. Progressive muscle relaxation: focused attention on relaxation of all major muscle groups. Guided imagery: replaces fearful thoughts with visualization of peaceful, nurturing scenes. Conscious breathing: focused attention of breathing to enhance relaxation. Positive self-talk: learned consciousness of replacing negative, fearful thoughts with reassuring, positive messages to self	Effective method for anxious patients who have had previous negative medical experiences, those who require repeated medical procedures, high anxiety levels.	Generally requires professional "coaching" and 4 to 6 weeks of practice before medical encounter. Efficacy often enhanced by presence of "coach" during procedure. Less effective for children undergoing prolonged procedures. Requires child's ability to engage in self-regulating behavior	Trained health care professional: may be child life therapist, nurse, behavioral therapist, social worker	A
Biofeedback	Promotes conscious relaxation via feedback provided by physiological monitoring equipment	High acceptance by children	Minimal data supporting efficacy. Requires skilled professional and sophisticated monitoring equipment. Training period ≈6 wk.	Behavioral pediatrician or psychologist	C
Play therapy	Use of directed play activities to provide information and process stressful experiences	Highly effective method that incorporates child's usual means of processing information/life experiences	Requires age-appropriate toys, medical "props," activity area	Trained health care professional: may be child life therapist, nurse, behavioral therapist, social worker	B
Attention diversion techniques/distraction	Incorporates various methods of redirecting child's focus away from stressful stimuli	Powerful intervention for young children, sensitized children, and when preprocedure preparation in advance is not possible	Requires focused attention of health care provider to engage child's attention, although this may be a role that parents can assume. Requires availability of books, games, video, music	Trained health care professional, role that technicians/parents can assume.	A
Peer modeling	Uses a variety of methods (videotape/written/audio-visual) to demonstrate positive coping during similar circumstances	Effective method for adolescents and naive children	May increase anxiety in children with previous aversive medical experience. Paucity of high-quality materials available for heart-related procedures	Age-appropriate materials, audiovisual materials, trained hospital personnel to answer questions, promote discussion	A
Peer counseling	Uses direct interaction with peers (either in person or online) who have successfully managed similar stressful circumstances and thus can serve as a positive role model	High acceptance by adolescents (congruent with peer focus and developing independence from families)	Issues of appropriateness/privacy when direct interpersonal interaction involved	Health care professional to link teens/families and provide ongoing consultation. Interested teens/families to act as peer counselors	C

*Studies done on a variety of populations. Generalizability to children with CHD undergoing invasive procedure unclear.

†Levels of evidence for efficacy of interventional methods: A indicates data derived from multiple randomized controlled trials; B, data derived from single randomized trial or nonrandomized studies; and C, consensus opinion of experts.

Appendix C

Age-Appropriate Interventions Before Cardiac Catheterization or Surgery

Cognitive Developmental Stage (Piaget)	Approximate Age Ranges	Age-Appropriate Interventions	Timing of Intervention
Sensorimotor period Learns via sensory input Separation/stranger anxiety Minimal conceptual abilities	Birth to 2 y	Maximize parental involvement in child's care Avoid separation from parents whenever possible Use of transitional objects Adequate sedation/pain medication	During procedure
Preoperational period Egocentric, concrete thinking Illness caused by external events Learning via hands-on experience Rudimentary concept of time/past/future	2 to 7 y	Books about going to the hospital Preoperative classes Medical play Refocusing during stress points Proximity to caring personnel, favorite toy	15-minute session day before procedure. 6- to 7-year-olds may benefit from earlier intervention (1 wk before) Child questions useful indicator of learning readiness and content
Concrete operational period Logical thinking (cause/effect) emerges Concept of past and future Awareness of internal body parts and function Fear of loss of body parts, disability, loss of control	7 to 11 y	Information-giving: brief verbal description using age-appropriate terminology Books about going to the hospital Medical play: include anticipated sensory experiences Peer modeling tapes Coping-skills training Biofeedback	Information-giving: initiate 1 week before procedure For highly anxious and/or experienced children, coping-skills training or biofeedback initiated 6 weeks before procedure
Formal operational period Abstract thinking available Independence from parents Peer focused	12 to 15 y	Information-giving: include anticipated sensory experiences Peer counseling Peer modeling tapes Coping-skills training Biofeedback	Information-giving: begin at time decision is made. Peer counseling at any point in time Coping-skills training/biofeedback: 6 weeks before procedure

Acknowledgments

The authors thank the Expert Consultants David R. DeMaso, MD, Associate Chief, Department of Psychiatry, Children's Hospital, Boston, Mass; Priti P. Desai, MSc, MPH, CCLS, Child Life Coordinator and Visiting Instructor, Child Development and Family Relations Department, East Carolina University, Greenville, NC; and Sharon Langshur, MD, Pediatrician, mother of a child with hypoplastic left heart syndrome, for reviewing the manuscript.

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KEY WORDS: AHA Scientific Statements ■ heart defects, congenital ■ catheterization ■ pediatrics