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Timing of Elective Surgery on the Genitalia of Male Children With Particular Reference to the Risks, Benefits, and Psychological Effects of Surgery and Anesthesia

Section on Urology

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Section on Urology

In 1975 an action committee of the American Academy of Pediatrics (AAP) Section on Urology published its recommendations for the timing of elective surgery on the genitalia of male children.[1] The committee concluded at that time that "the ideal age for orchiopexy is after age 4 and before age 6 unless a symptomatic hernia is present." Hypospadias surgery was best performed sometime after the child's third birthday.

In the years since that report, the approach to these common childhood problems has been modified significantly as a result of a combination of factors, particularly the following: an improved understanding of the psychological implications of genital surgery in children; improvements in the technical aspects of surgery for hypospadias; clarification of the natural history of undescended testes; and advances in pediatric anesthesia. These changes have resulted in the AAP requesting that a committee reevaluate the previous recommendations for the timing of male genital surgery. The Action Committee on Surgery has considered the age-related anesthetic and/or surgical risks and benefits in relation to the psychological impact of these procedures during the various stages of the child's development.

PSYCHOLOGICAL FACTORS

Emotional Development

Several studies[2,3] have demonstrated that during the first year of life, opportunities for establishing a strong and stable mother-father–infant relationship must be fostered. The quality of this attachment will be affected by many variables; one of these, congenital birth defects, may influence the mother's attitude toward the child.

From the viewpoint of emotional development, the period from 6 weeks to approximately 15 months of age generally seems to be a relatively less-difficult psychologic developmental period for surgery if parental separation is limited. The period from 24 to 36 months of age also may be a time when the trauma of surgery is relatively less difficult. However, that period has the disadvantage of potentially prolonging the child's "defective" status and crystallizing any disruption in family relationships that the child's condition may have produced.

Body Image and Sexual Development

In large part, the body image of a child is derived from the social interactions with the primary care givers and peers. A child with an external birth defect, including hypospadias, is at risk of developing distortions of body image that reflect other people's subtly communicated evaluations of the child's body. Given the early development of body image and the importance of parental response, the implication for repair of hypospadias is that the earlier the repair can be achieved, the more likely the child will achieve a psychologically healthy perspective of body image.

A specific area in which social feedback affects body image is sexual development. Research on children with ambiguous genitalia has shown that sexual identity is a function of social learning through differential responses of multiple individuals in the environment.[4-6] For example, children whose genetic sexes are not clearly reflected in external genitalia (ie, hermaphroditism) can be raised successfully as members of either sex if the process begins before the age of 2½ years. Therefore, a person's sexual body image is largely a function of socialization.

School-aged boys with hypospadias are more likely to have behavior that is gender atypical when compared with that of boys without hypospadias.[7] The severity of the anomaly does not predict the degree of feminine behavior. The repair of hypospadias before 30 months of age seems optimal for the following reasons: (1) awareness of the different sexes as well as the presence of a physical deformity occur at that time; (2) socialization of boys of that age creates situations in which comparison of genitalia occurs—nursery schools often provide this opportunity, and boys who sit to urinate or who have readily visible penile defects will be exposed to the social responses of peers; and (3) from the age of 30 months to at least 5½ years, the boys' fears of physical harm are significant and may be exacerbated by surgery.[8,9] These older boys facing repair of hypospadias need reassurance that their sex will not be altered in any way and that they are already completely male.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Cognitive Development

Cognitive aspects of the preparation of a child younger than 18 months old for surgery are necessarily limited. Children nearly 2 years of age, however, can comprehend that they will be in a strange environment and receive treatment. Between the ages of 2 and 7 years,[10] children can understand more information and still will require simple, consistent, and concrete explanations of what they will experience and how long they will be away from home, who will be with them, and when and where they will feel pain. Such children are egocentric in theirs view of the world and, therefore, need clear, consistent statements of negative causality, such as, "your operation is not your fault or a punishment." Thought may be illogical during this period and, unless one is careful, a child may later have misunderstandings. A child who has attained the capacity for operational thought (7 years of age or older) will be able to understand causality in a more adult-like fashion but still may unconsciously associate surgery with punishment.

Psychological Effects of Surgery and Anesthesia

In 1945, Levy[11] published the first study to address specifically the question of the psychological effects of surgery on children. He noted that the highest incidence of postoperative emotional disturbance was seen in children between the ages of 1 and 3 years. Characteristic types of problems were prolonged night terrors (children between 1 and 2 years), negativism (children older than 4 years), and various fears (including phobias, hysterical reactions, and anxiety reactions) in all age groups. Levy reasoned that surgery represented a greater emotional hazard to the 1- to 3-year-olds because of their poorer comprehension, increased dependency on their mothers, decreased social contacts outside the home, and decreased facility to handle anxiety.

Jackson[12] examined emotional trauma in children who underwent tonsillectomies. Thirteen (9%) of the 140 children had postoperative behavior changes that were thought to be indicative of emotional trauma. Again, children between the ages of 1 and 3 years were at increased risk for postoperative behavioral changes.

Vernon and associates[13] examined the psychological response to anesthesia and surgery in 22 children 2 to 6 years of age. The factors that increased susceptibility to postoperative emotional stress were age, length of hospitalization, and the particular anesthesiologist involved. Factors not considered significant by the authors included birth order, gender, prior hospitalization, the preoperative behavior of the child, characteristics of the illness or treatment, the degree of pain during hospitalization, or the presence or absence of the mother during induction of anesthesia. They suggested that reducing the child's unfamiliarity with the hospital environment may reduce the incidence of distress after surgery.

Inadequate preoperative sedation in young children may result in excessive preoperative fear and anxiety in addition to postoperative emotional disturbances.[14] Deliberate falsehoods and deceptions increase the potential for postoperative emotional disturbances in older children, because, ultimately, the children are confronted with the truth. Davenport and Werry[15] compared the behavior of 145 children undergoing tonsillectomies to that of siblings and healthy control children and concluded that brief hospitalization, minor surgical pain, and skillful anesthesia produce no residual behavioral effects in the majority of children.

The definitive study of the psychological risks of the surgery and anesthetic will never be done, because it is difficult to isolate the psychological stress inflicted by hospitalization, anesthesia, and surgery. Existing data, however, suggest that certain groups of children may be at increased risk of postoperative behavioral sequelae. An individual anesthetist's rapport with a child can lessen the incidence of stormy inductions. Older children benefit from clear and honest explanations of anesthesia, surgery, and hospitalization; a familiarity with the hospital and surgical environment is also helpful.

Anesthetic Considerations

Pediatric anesthesia has come of age during the last 10 to 15 years, with a number of dramatic improvements. Perioperative monitoring has improved considerably with the use of pulse oximetry to reduce both intraoperative and postoperative hypoxemia in infants and children, and this technology is now routine in pediatric centers. Advances in pharmacology have produced shorter-acting synthetic narcotics and muscle relaxants, resulting in safer and more-stable anesthesia. An improved understanding of the unique physiologic responses of neonates, infants, and children to anesthesia has resulted in improved management of respiratory problems, cardiovascular responses, and fluid and electrolyte balance, as well as temperature regulation. Caudal anesthesia has been used with increasing frequency for postoperative analgesia in the pediatric population, as well as to reduce requirements for intraoperative anesthesia. In addition, pediatric anesthesiologists have acquired an improved understanding of the important psychological differences between children of different ages, as well as an increased awareness of the importance of minimizing the period of parent-child separation.

Most studies of anesthetic risk are not stratified by age and American Society of Anesthesia (ASA) class, and therefore, it is difficult to determine the precise anesthetic mortality rate for ASA class I patients between 6 and 12 months of age. Furthermore, most studies do not consider relative surgical magnitudes; however, it is reasonable to assume that the anesthetic risk for the repair of hypospadias and orchiopexy is probably less than that for major intra-abdominal or cardiac procedures.

Tiret et al[16] reported a mortality rate of 1 in 40 000 in a prospective survey of anesthesia-related mortality and morbidity in infants and children in 440 institutions chosen at random in France. Smith[17] reported no deaths in 37 000 cases of tonsillectomy and only 1 anesthetic death in 29 000 procedures of all

types. Mayhew and Guiness[18] reviewed a total of 33 636 pediatric patents undergoing anesthesia and found only 2 incidents of cardiac arrest in ASA class I patients, an incidence of cardiac arrest of 1 in 16: 800. Both of these children recovered without incident. Patel and Hannallah[19] confirmed the safety of pediatric outpatient anesthesia.

Roy and Lerman[20] found an increased risk of laryngospasm in infants between 1 and 3 months of age. The incidence remains fairly constant between the ages of 6 months and 9 years. It is difficult to document an increased incidence of laryngospasm in children between 6 and 12 months of age when compared with older children. There is an increased risk of postoperative hypoxemia in young children that may persist for several hours even after uncomplicated anesthesia. The recommendation for supplementary oxygen in the recovery room has reduced this potential problem significantly. With the routine use of a pulse oximeter as well as other intraoperative and postoperative monitors, undetected hypoxemia should be rare. Other significant complications of anesthesia, including aspiration of gastric contents, hypotension, malignant hypothermia, and halothane-associated hepatitis, do not seem related to age.

These data suggest that after the first 4 to 5 months of life, age alone is not the major risk factor, as long as the anesthetic is administered by an anesthesiologist with significant pediatric experience and appropriate monitoring is used.

Undescended Testes

Recognition of the changes in the treatment of cryptorchidism during the last decade are best understood by contrasting current practices with the outdated recommendations from the last AAP Section on Urology Action Committee report in 1975. At that time it had been indicated that:

1. Primary dysgenesis (a congenital lesion) was present in 20% to 100% of cryptorchid testes;
2. The critical timing of histological deterioration occurred between 4 and 10 years of age, although some testes were suspected to be affected as early as 1 year; and
3. Little evidence for spontaneous descent after 1 year was found. The report concluded that orchidopexy should be performed after the fourth birthday, although there were indications that earlier orchidopexy might be beneficial. The challenge was issued that it would be "... the responsibility of those that promote . . . early orchidopexy to prove . . . the efficacy of such an approach."[1]

In the intervening period, the challenge to prove the efficacy of early orchidopexy has been met. The overwhelming impetus for earlier surgery has been the clear-cut documentation that histologic deterioration in cryptorchid testes begins during the second year of life. Studies indicate that between 0 and 6 months, virtually all cryptorchid testes examined histologically appear normal.[21] At 1 year, although there is some variation in germ cell numbers, with some cryptorchid testes having lower counts than normal, mean values do not deviate from normal.[22] By 2 years, 30% to 40% of testes are aspermatogenic.[21,23] Further germ cell deterioration occurs progressively with increasing age. In addition to these quantitative changes, qualitative changes in the germ cells (increased nuclear size and increased DNA content) have been demonstrated in older boys, 6 to 18 years of age, possibly representing premalignant cells or those qualitative changes relating to fertility reduction later in life.[24] Although the germ cells are the target regarding fertility, significant histologic changes in other cells, especially Leydig's cells, occur early. Abnormal hormonal correlates of these histologic abnormalities have been demonstrated even in infancy, with a reduction in the response of luteinizing hormone to gonadotropin-releasing hormone stimulation.[25] Subsequent infertility correlates of these abnormalities exist. A direct relation has been shown between prepubertal germ cell counts in cryptorchid biopsies and sperm counts in the semen analysis of the same patients in adulthood.[26] To date, only one study relates fertility to the age at which orchidopexy was performed. In this study, 90% of men were fertile when orchidopexy had been performed when they were between 0 and 2 years; 50% were fertile when it had been performed between 3 and 4 years; and 30% were fertile when it had been performed between 9 and 12 years.[27]

These studies suggest that damage in cryptorchid testes is not congenital, and that the associated testicular deterioration should be considered a disease process, not a congenital malformation. Primary dysgenesis is seldom identifiable as a cause of these observed histologic abnormalities. Timely intervention in relocating these testes to the scrotum is likely to prevent histologic deterioration. As with other genital procedures, improved surgical technology has lowered the age at which successful orchidopexy can be performed. Miniaturized instrumentation, fine suture materials, optical magnification, and improved surgical techniques now allow orchidopexy to be performed safely in children 1 year of age. The complication rate for orchidopexy performed by pediatric subspecialists is not greater for young children than it is for older patients.[28] Whereas orchidopexy in 1955 was associated with an 8-day inpatient stay,[29] virtually all orchidopexies for palpable testes are now performed on an ambulatory basis.

In summary, there are strong indications that deterioration of cryptorchid testes begins around 1 year of age. These deteriorative changes may be irreversible and may correlate ultimately with poor semen quality. Because spontaneous testis descent after 6 months of age is unlikely, the need for treatment after that time is evident. Because orchidopexy at 1 year of age can be done safely in experienced hands, we recommend it at that age or soon thereafter as the optimal current treatment for children with cryptorchid testes.

Hypospadias

In the previous report of the action committee, reconstructive surgery for hypospadias was recommended for patients when they were at an age when the potential for an excellent functional and cosmetic result was thought to be optimal. Technical considerations were thought to have the greatest influence on the timing of surgery. At the time of that report, multistage reconstructive techniques with independent chordee correction and the urethral reconstruction separated by an interval of 6 to 12 months were the rule. Children frequently remained in the hospital for 5 to 14 days after each surgical procedure, and parental rooming in was not routine in all centers.

Today, experienced surgeons who perform reconstructive surgery for hypospadias can accomplish the vast majority of repairs of hypospadias with a single-stage procedure; multistage repair is reserved for only the most severe malformations. Despite the fact that more complex and time-consuming single-stage reconstructions are commonly performed, many surgeons are regularly performing surgery for hypospadias when children are 6 months of age.[30,31] The routine use of optical magnification, microinstrumentation, and delicate suture material has made surgery for hypospadias in small infants technically feasible,[32,33] and experienced surgeons can perform early reconstructive surgery with cosmetic and functional results at least equal to those achieved in older children.[34,35] However, not all institutions have individuals on their staffs who are experienced and comfortable with the complexities of surgery for hypospadias in young infants, and under these circumstances, the surgical risks may be increased.

Paradoxically, as more complex reconstructive procedures are performed in much younger children, the requirement for postoperative hospitalization has been reduced dramatically. Currently, the majority of operations for hypospadias are now performed as outpatient procedures or with only overnight hospital stays, thereby minimizing the period of potential parent-child separation and, theoretically, much of the emotional trauma associated with the surgery. When a hospital stay is required, most centers take great care to minimize the time of parent-child separation; rooming in is routine in most pediatric centers. When a child is cared for in a hospital where the above criteria can be met, surgery for hypospadias optimally should be performed when the child is 6 to 12 months of age.

SUMMARY

Technical considerations are no longer the major limiting factors in determining the timing for the surgery of undescended testes or hypospadias, because experienced pediatric urologic surgeons can perform these operations on young children safely and reliably. Important theoretical considerations suggest that early orchidopexy is preferable, particularly in minimizing the histologic injury that occurs with increasing age. There does not seem to be an increased risk when orchidopexy is performed in children 6 to 12 months of age, compared with the risk in older children, provided that it is performed by surgeons, nurses, and anesthesiologists with pediatric training and experience.

Emotional, cognitive, and body image development may be affected profoundly by both the genital deformity and the reconstructive surgery. These psychological factors are of considerable importance, in that a child's reaction to both the surgery and the anesthetic trauma varies dramatically with age. Postoperative behavioral problems such as aggressive or regressive behavior, night terrors, and anxiety may be more common at certain ages, particularly at 1 to 3 years of age. The period from 6 weeks to 15 months is a relatively good time for surgery from the viewpoint of emotional development, provided parent-child separation is minimized; this period has the additional advantage that the child's "defective status" within the family is not prolonged. The importance of the care giver's attitude toward the child may be of particular importance to the child's developing body image. Superimposed on all of these factors is the developing sexual identity of the individual, which again suggests that, in the absence of any other health factors, successful early genital surgery minimizes disturbances in the patient's psychological development.

The best time for surgery for hypospadias is between 6 and 12 months of age. Orchidopexy should be performed at or near 1 year of age. If the improved risk-to-benefit ratio for this early genital surgery is to be achieved, it is essential that children undergoing this surgery be cared for at facilities with experienced pediatric support personnel, particularly in the areas of anesthesia, urology, and nursing, who are sensitive to the special needs of children.

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