Cryptorchidism in Sweden: A Nationwide Study of Prevalence, Operative Management, and Complications

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Objectives To review the cumulative prevalence, operative management, and complications of treatment for cryptorchidism in Sweden.

Study design A nationwide observational study from longitudinal register data of all Swedish-born boys 0-18 years of age, diagnosed with cryptorchidism from 2001 to 2014. Primary outcomes were occurrence and age at primary surgery. Secondary outcomes included type of procedure and surgical site infection.

Results Of 20 375 boys diagnosed with cryptorchidism in 2001-2014, 12 766 were surgically treated. The cumulative childhood prevalence was 1.8% (95% CI, 1.5-2.0), with a higher prevalence in boys born prematurely, small for gestational age, or with low birth weight. The median age at treatment decreased from 6.2 years in 2001 to 3.4 years in 2014 ($P < .001$). Still, 94.1% (95% CI, 92.7-95.6) had surgery after the recommended 1 year of age in 2014. Variations in age at surgery between Swedish counties were great (range, 2.9-5.9 years of age). There were no deaths within 30 days after surgery and the frequency of surgical site infection was low (1.4%; 95% CI, 1.1-1.6).

Conclusions The cumulative childhood prevalence of cryptorchidism was high, and complications were rare. Few boys underwent surgery in a timely manner according to clinical guidelines, and standards of care varied considerably across the country. Further research and collective actions are needed to improve the detection and management of congenital cryptorchidism. *(J Pediatr 2018;192:1-).*

Cryptorchidism has a prevalence at birth of 1%-9% of boys.[1,2] Risk factors include low birth weight, intrauterine growth restriction, and prematurity.[3,4] Corrective surgery is the only treatment, and there is a correlation between advancing age at surgery and a subsequent risk of subfertility and cancer.[4,5] Therefore, Nordic guidelines for congenital cryptorchidism were established in 2007,[4] and the recommended age at surgery was advanced to 6-12 months of age, in line with international guidelines.[6]

Swedish national registers offer unique opportunities for comprehensive nationwide analyses. In this study, we present the cumulative prevalence of disease, age at primary surgery, frequency of surgical techniques, and postoperative complications. The purpose of this registry-based analysis was to produce a comprehensive overview of surgery for cryptorchidism for an entire national population over time.

Methods

We conducted a nationwide registry-based study of a dynamic population consisting of all Swedish-born boys, 0-18 years of age, diagnosed and treated for cryptorchidism between January 1, 2001, and December 31, 2014.

Annually, 47 000-59 000 males were born in Sweden during 2001-2014.[7] The healthcare system is publicly funded and accessible to all Swedish citizens, with high adherence to mandatory well-child checkups. Sweden is divided into 21 counties and 6 healthcare regions.[7] Each region is served by 1 university hospital, several general or local hospitals, and multiple pediatric public health centers. Advanced pediatric surgery has been centralized to 4 hospitals.

Clinical screening for cryptorchidism is performed through physical examination at birth and as part of subsequent healthy child checkups at 4 weeks, 6 months, and 12 months of age. Cryptorchidism can be congenital or acquired,[8-11] and any boy with suspected cryptorchidism at >6 months of age should be referred to a surgeon or urologist for final diagnosis, usually without prior imaging.[4] Referral to hospitals with pediatric surgeons and pediatric anesthesiologists is recommended for surgery before 1 year of age.[4] The corrective surgery is usually performed as an outpatient procedure under general anesthesia with an inguinal nerve block.

Inclusion and exclusion criteria are presented in **Figure 1**. Only Swedish-born boys were included because previous medical history of foreign-born patients was unknown. Patients with comorbidities likely to influence standard of care were

ICD10 *International Classification of Diseases, 10th revision*

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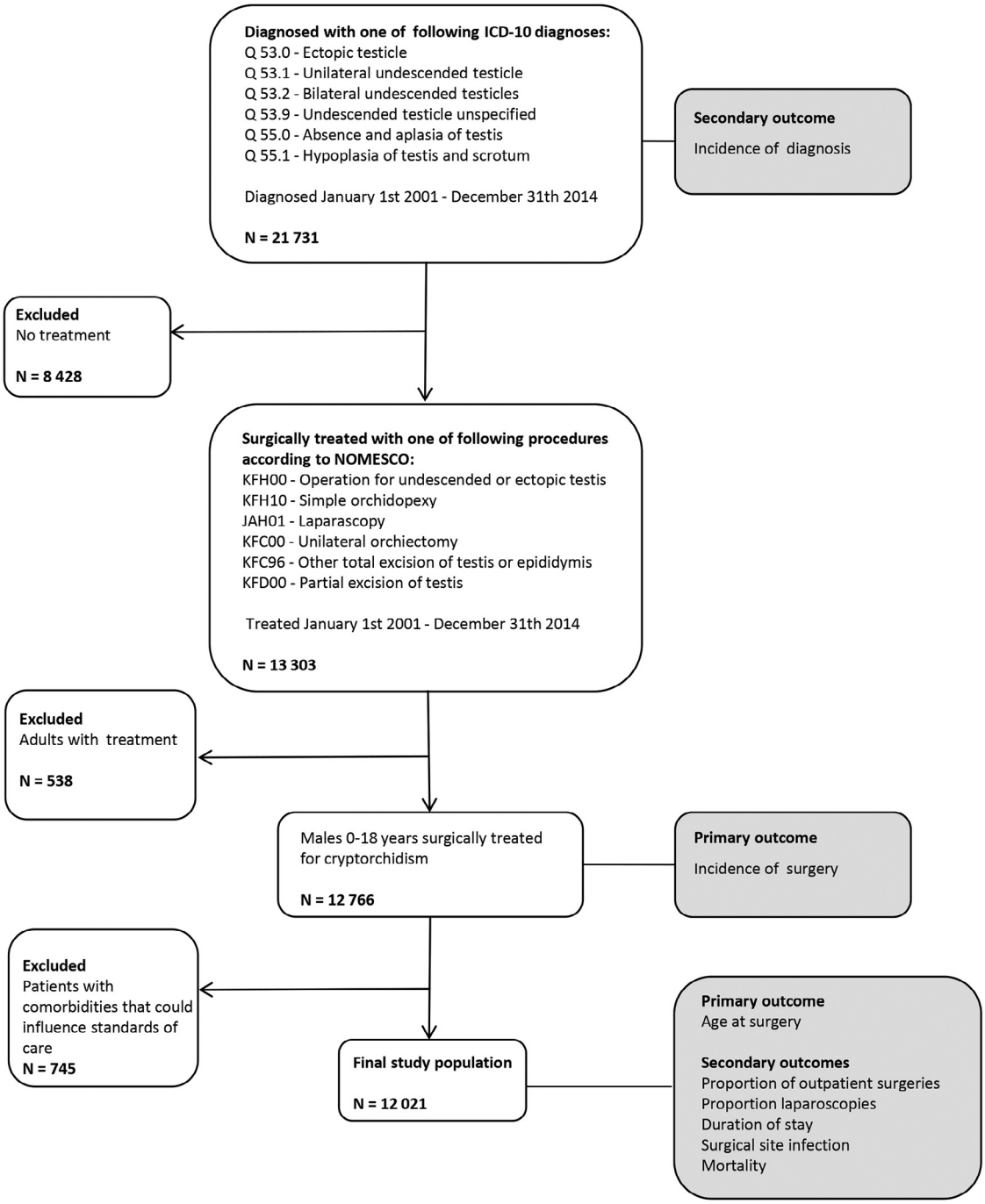

Figure 1. Inclusion criteria, exclusion criteria, and outcomes. All males 0-18 years of age, born in Sweden and diagnosed or treated for cryptorchidism 2001-2014 were included. Comorbidities with risk of influencing standard of care are defined in **Table I**. *NOMESCO*, Nordic Medico-Statistical Committee.

excluded from analysis of clinical management (**Table I** [available at www.jpeds.com] based on EUROCAT's list of minor malformations[12]).

Study subjects were identified through the Swedish National Patient Register, with records of public and private inpatient and outpatient care. Information of birth weight, gestational age, and size for gestational age were obtained from the Medical Birth Register. Demographic information was obtained from Statistics Sweden and The National Board of Health and Welfare. Records of prescribed antibiotics were collected from the Swedish Prescribed Drug Register and information on mortality from the Swedish Cause of Death Register. All data were linked by a unique national ID number. Diagnoses were defined according to the *International Classification of*

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