ENURESIS

THESIS

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Urology

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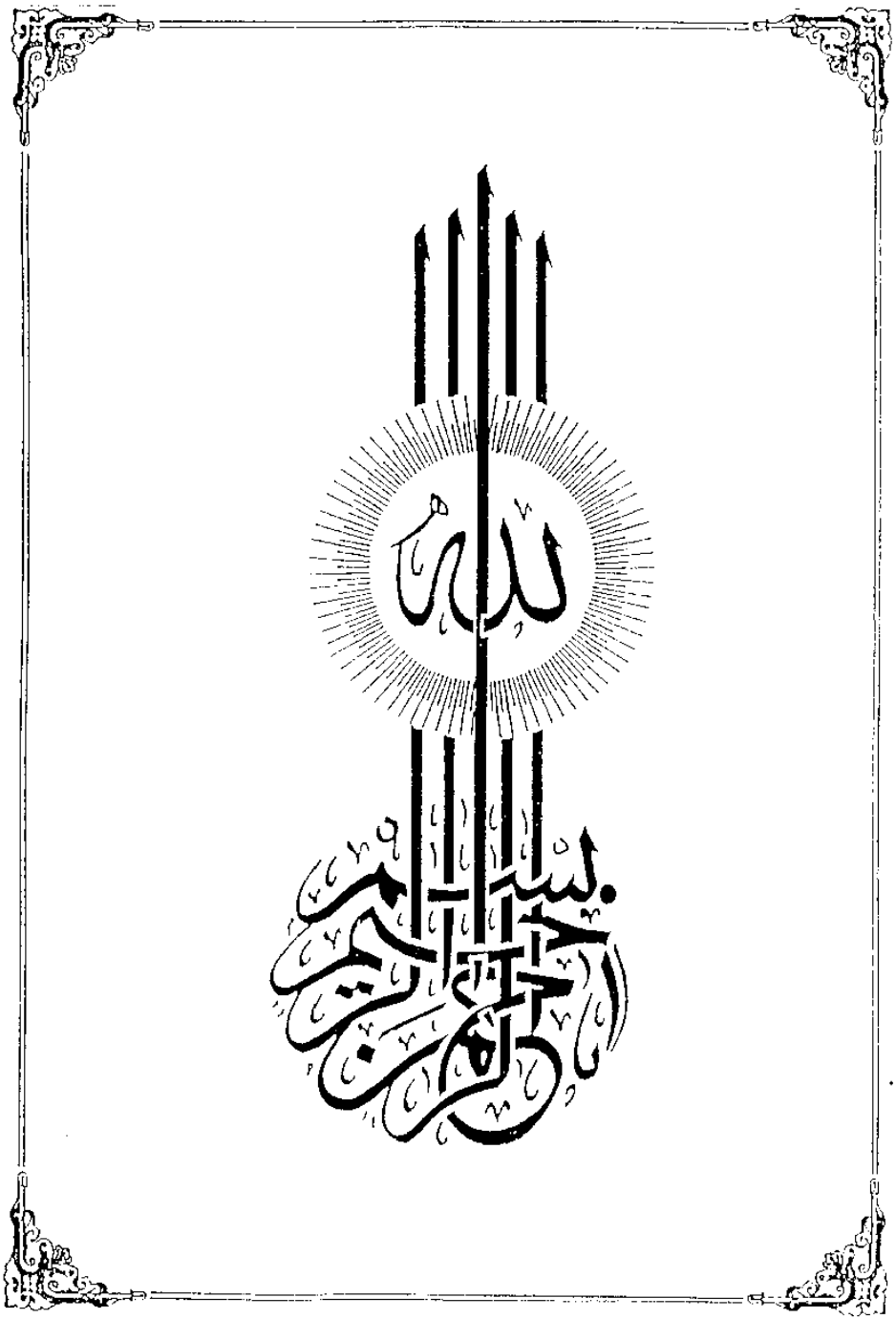
C O N T E N T S



INTRODUCTION

INTRODUCTION AND HISTORICAL REVIEW

Enuresis is a source of worry to many parents and a problem which urologists, pediatricians, and neuropsychiatrists sometimes have difficulty in resolving. It is the most frequent urologic complaint in the child and approximately 15% of all 5-year -old children still wet at night (Forsythe and Redmond, 1974).

The word "Enuresis" has been used to mean inappropriate or involuntary voiding or loss of urine at an age when control would be expected. "Enuresis" is more frequently used to mean nighttime bed wetting although some use the phrase" nocturanal enuresis" (Altchek, 1982).

The word " enuresis " is derived from the Greek "enourein"- to void urine. Glicklich (1951) has written an excellent history of the medical literature concerning the syndrome dating back to the Papyrus Ebers of 1550 B.C. Nearly all the ancient physicians ascribed the defect to something lacking in the kidney, bladder or testicles and they naturally turned to extracts of these organs taken from animals when seeking a remedy.

Major and Ziem (1971) (see Salmon, 1975) explained enuresis in mouth-breathing children as being due to

carbonic acid poisoning, while in the same paper Jacobi (see Salmon. 1975) incriminated masturbation as a cause in adult enuresis, and stated that treatment was quite simple total body massage with a mixture of alcohol and water.

Ruddock (1878) (see Salmon, 1975) thought that hypertrophy of the bladder musculature with increased contractility might be responsible while Trousseau (1870) (see Salmon,1975) Disputed this putting the underlying pathology down to phimosis which resulted in reflex contraction of the bladder. This view gained considerable popularity and even during the past decades phimosis, ureterotrigonitis and coronal adhesions have all been put forward as an underlying pathology.

In 1880, Simons (see Salmon, 1975) thought that preputial adhesions cause irritation and that by removal of them, he might promote a cure.

Circumcision was advocated as a treatment and in 1889, Baruch (see Salmon, 1975), substituted this by recording that in a New York Asylum for Jewish orphans only 1% out of 540 inmates wet their beds.

REVIEW OF LITERATURE

1- PHYSIOLOGY OF MICTURITION

Micturition is the process by which the urinary bladder empties itself when it becomes filled. Basically the bladder (1) Progressively fills untile the tension in its walls rises above a threshold value at which time (2) a nervous reflex called the "micturition reflex" occurs that either causes micturition or if it fails in this at least causes a conscious desire to urinate (Guyton, 1966).

Innervation of the bladder

The bladder is supplied by the parasympathetic and sympathetic nervous system. In man however, the sympathetic plays only a minor role in bladder physiology.

The Parasympathetic innervation arises from spinal cord segments S2-4 and proceeds through the pelvic nerve (nervi erigents) to the bladder, e.g. to the pelvis plexus. The preganglionic pelvic fibres have synapses in ganglia lying partly outside and partly on the wall of the bladder.

Accessory parasympathetic nerve fibres reach the bladder directly, they do not run in the pelvic

nerve but as separate tracts in the lateral pelvic fascia. This explains why the parasympathetic innervation of the bladder is not altogether abolished after intrapelvic operations such as amputation of the rectum.

The sympathetic preganglionic fibres arise from segments T11-12 and L1-4, they end in the inferior hypogastric ganglia, where the postganglionic innervation arises.

The pudendal nerve, a mixed somatic nerve recieves efferent fibres from segments S3-S4, they supply the striated musculature of the urethra and pelvis reaching up to the orifice of the bladder. In addition it comprises sensory fibres extending from the posterior urethra to the spinal cord.

[illegible]

The precise neurologic pathways concerned with micturition have not been elucidated completely to date but 3 major theories have been proposed. Common to these theories is the recognition that the storage and timely expulsion of urine are part of a complex viscerosomatic function that involves the autonomic and somatic nervous system.

It long has been recognized that the second through the fourth segments of the sacral spinal cord contain neural pathways involved in a micturition reflex. The pelvic parasy-mpathetic nerves contain the major afferent and efferent pathways mediating this reflex. A major source of controversy has centered about the question of what neural pathways modulate this seemingly simple relfex arc. The theory proposed by Denny-Brown and Robertson (1933), suggests that the micturition reflex is nothing more than a local sacral reflex mediated entirely by the pelvic and pudendal nerves. According to this theory bladder distension stimulates afferent fibres of the pelvic nerve, which enter the spinal cord via the posterior roots of the second through fourth sacral segments. These fibres synapse with neurons of the pelvic and pudendal nuclei. The resulting efferent discharges traverse the anterior roots of the pelvic and pudendal nerves to cause detrusor contraction and striated sphincter relaxation. The micturition reflex may be either facilitated or inhibited by descending central nervous system pathways.

The theories of Bradley (1974) and De Groat (1979) and their associates deny that normal voiding

is the result of a simple segmental sacral detrusor reflex as such. These investigators believe that local stimuli arising from the bladder cause afferent discharges in the pelvic nerve, which traverse pathways in the spinal cord to synapse in a supraspinal micturition center in the pontine mesencephalic reticular formation. This pontine micturition center modulates the neural impulses in such a manner to effect detrusor contraction and sphincter relaxation. According to Bradley and associates (1974) voluntary control of voiding is accomplished by connections between the frontal cortex and the micturition center in the restoral pons.

Voluntary control of the striated sphincter is mediated by a corticospinal pathway connecting the frontal cortex with the pudendal nucleus. The theories of Bradley (1974) and De Groat (1979) and their associates differ mainly over the existence of a synapse between efferent fibres of the pontine mesencephalic reticular formation and the pelvic nucleus, which De Groat and associates have demontrated in the cat but which Bradley and associates deny. In addition De Groat and associates (1979) have stressed the importance of the sympathetic nervous system in modulating

lower urinary tract function but Bradley et al.(1974) do not mention it.

Loop Concept Of Bradley et al:

Bradley et al.(1974) hypothesize the existence of four neuro-anatomic circuits affecting voiding.

Loop I consists of axonal pathways to and from the detrusor motor area in the frontal lobes to the detursor motor area in the pontine-mesencephalic reticular formation. This pathway has relays to and from the thalamus, basal ganglia, and limbic system. The output of the basal ganglia and the limbic system acts to depress neural activity associated with detrusor reflex contraction in the loop, whereas the hypothalamus facilitates the detrusor reflex. Maturation of loop pathways may delayed in nocturnal enuresis and their ablation or injury often results in uninhibited bladder activity.

Loop II comprised of the proprioceptive detrusor sensory pathways, the detrusor motor area in the pontine-mesencephalic reticular formation and the reticulospinal tracts that arise in the brain stem and conduct impulses to the intermediolateral cell column in the lumbar and

sacral grey matter. The anatomic integrity of this loop is a necessary prerequisite for development of a coordinated detrusor reflex of adequate temporal duration to produce total evacuation of intravesical content.

Loop III consists of connections between the detrusor nuclei and the pudendal nuclei in the grey matter of the sacral spinal cord. Whenever detrusor afferents are stimulated by bladder contraction impulses are generated that inhibit the striated musculature of the pelvic floor. The net result of operation of this loop is coordination of detrusor and urethral function.

The fourth circuit consists of the sensory and motor tracts from the motor strip in the frontal cortex to the pudendal nucleus. The net effect of these impulses is to provide voluntary control of the contraction and relaxation of the straited urethral sphincter. Since the periurethral striated muscle is of substantial bulk in the male but is only a rudimentary structure in the female, this loop is of greater significance in male than female continence.

We can summarize all the above data according to Yeates (1982) in the following acceptable hypothesis: coordinated micturition (that is a sustained bladder contraction combined with reciprocal relaxation of the pelvic floor), requires reflex arcs about as high as the upper part of the brain stem and the hypothalamus, and it is useful to conceive of their being a functional micturition centre at this site. Even in infancy micturition is a coordinated act so that it occurs through the same centre. This centre is charged by impulses from the distending bladder. When a sufficient number have accumulated the tension in the centre is transmitted to the cerebral cortex producing an ealy warning of bladder distension. The tendency for the centre to fire down the efferent tract to stimulate bladder contraction is suppressed by unconscious inhibitory impulses from the basal ganglia and the cerebral cortex. Later these are reinforced by inhibitory impulses from the cortex. When micturition is desired the excitatory state in the centre is supplemented by stimulation from the cerebral cortex combined with removal of the inhibition. Micturition then occurs by the combination of a sustained bladder contraction with reciprocal relaxation of the pelvic floor.