

Continence

Abdel Karim M. El Hemaly^{1*}, Laila A. Mousa², Ibrahim M. Kandil¹ and Khulood Sami Hussein³

¹Obstetrics and Gynecology, Faculty of Medicine, Al Azhar University, Cairo, Egypt

²Faculty of Medicine, Al Azhar University, Cairo, Egypt

³Faculty of Medicine, King Abdul Aziz University, KSA

*Corresponding author: El Hemaly AKM, professor Obstetrics and Gynecology, Faculty of Medicine, Al Azhar University, Cairo, Egypt, Tel: +202-22607085; E-mail: profakhemaly@hotmail.com

Rec date: July 4, 2016; Acc date: July 27, 2016; Pub date: August 3, 2016

Copyright: © 2016 El Hemaly AKM, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Introduction: Continence is self-restraint and self-control of the following items:

- Temperance and re-action,
- Sexual behavior,
- Body's excreta, the urine and the stool,
- Poor's due and Charity donation,
- Justice and honesty.

Pathophysiology: Continence is an acquired behavior gained by learning and training. An intact sound brain and central nervous system (CNS) control and master coordination between the sympathetic, parasympathetic, somatic nervous systems and the body's skeleto-muscular system and various body organ's response. The primary target of the sympathetic nervous system is to stimulate the body to "fight-or flight" response. Most people are born with the parasympathetic nervous system dominating the functions of the autonomic nervous system. We gain, progressively, rising up sympathetic tone from everyday life stress, annoyance, teaching, training and experience. A provoking stimulus will lead to one of four possibilities; 1-fight, 2, flight, 3, holding back (continence) and 4- if the offense is overwhelming it will lead to sympathetic failure and incontinence.

Mechanism of action: Continence is a nerve-muscle action, where the nerve secretes neurotransmitter, which acts on receptors on the target tissues. The neurotransmitter of the post-ganglion sympathetic system is nor-epinephrine (NE).

Body excreta control: Toilet training in early childhood leads to gaining high alpha-sympathetic tone at the internal urethral sphincter (IUS) and the internal anal sphincter (IAS) keeping the sphincters contracted and the urethra and the anal canal closed all the time.

Conclusion: The way to gain continence is how to control the sympathetic nervous system harmonized and mastered by healthy intact CNS, and it is how to control different responses according to social circumstances.

Introduction

Continence is self-restraint, self-holding back and self-control of the following items:

-Temperance and response re-action: is the response to actions to perform both by physical and/or verbal response. In addition, is by the control of aggressive re-actions.

-Sexual behavior and premature ejaculation: is to control sexual harassment, and aggressive and abnormal sexual behavior. In addition is to control premature ejaculation.

-Body's excreta, is the ability to control one's bowels and bladder.

-Poor's due and Charity donation: are money spending, community services, and sponsoring education, and social and charity projects.

-Justice and honesty: is to be fair and honest even on yourself, your relatives, and friends.

Pathophysiology

Continence is an acquired behavior gained by learning and training. An intact sound brain and central nervous system (CNS) control and master coordination between the sympathetic, parasympathetic, somatic nervous systems and the body's skeleto-muscular system and various body organ's response.

The primary target of the sympathetic nervous system is to stimulate the body to “fight or flight” response. Stimulation (excitation) of the sympathetic nervous system, in general, it excites the liver to release glucose, and increases the rate of metabolism of essentially all the cells of the body. It dilates the pupil of the eye. It increases the heart rate. It leads to rise in the blood pressure, “fight or flight”.

It is how to control the sympathetic nervous system is how to gain continence.

A provoking stimulus will lead to one of four probabilities; 1-flight, 2, flight, 3, holding back (continence) and 4- if the offense is overwhelming it will lead to sympathetic failure and incontinence.

Failure to control the sympathetic nervous system can be temporary failure or permanent failure. Temporary failure of the control of the integrative centers of the brain and the high CNS centers will mask its functions. This happens in situations like, getting drunk, fear, and high fever...etc. will lead to incontinence. Permanent failure is due to neuropathy: e.g. 1. Stroke, 2. Spinal cord lesions and 3. Peripheral nerve damage.

Most people are born with the parasympathetic nervous system dominating the functions of the autonomic nervous system. Parasympathetic nervous system’s target is to conserve energy. It promotes “body- keeping” functions: rest and digest; later is to feed and breed.

We gain, progressively, rising up sympathetic tone from everyday life stress, annoyance, teaching, training and experience.

Mechanism of Action

Continence is a nerve-muscle action, where the nerve secretes neurotransmitter, which acts on receptors on the target tissues. The neurotransmitter of the post-ganglion alpha-sympathetic system is nor-epinephrine (NE). NE in general, mobilizes the body for fight or flight actions. It dilates the pupil of the eye, increases the heart rate. It leads to rise in the blood pressure. It excites the liver to release glucose, and increases the rate of metabolism of essentially all the cells of the body.

Body Excreta Control

Toilet teaching and training in early childhood, leads to gaining high alpha-sympathetic tone at the internal urethral sphincter (IUS) and the internal anal sphincter (IAS) keeping both sphincters contracted and the urethra and the anal canal closed all the time.

Thus, an acquired high alpha-sympathetic tone at both the IUS and IAS are essential factors in keeping continence of body’s excreta. Failure to acquire high alpha-sympathetic tone at the IUS leads to nocturnal enuresis (NE). The failure can be partial failure that leads to bed wetting at night or complete failure that leads to day and night enuresis [1-7] (Micturition: Figures 1-5).

Micturition consists of two stages, first stage in infancy and early childhood and the second stage starts after toilet training. In the first stage, micturition is a sacral spinal reflex.

In the second stage, after toilet training, the person builds up, by learning and training, high alpha sympathetic tone, (T10-L2), at the internal urethral sphincter (IUS) keeping it contracted and the urethra closed and empty all the time.

Urinary continence is gained by having the urethral pressure (P_{ura}) much higher than the pressure in the bladder (P_{ves}). The high P_{ura} is due to two factors: the first factor is healthy, sound and strong internal urethral sphincter (IUS); and the second factor is the acquired high alpha-sympathetic tone at the IUS.

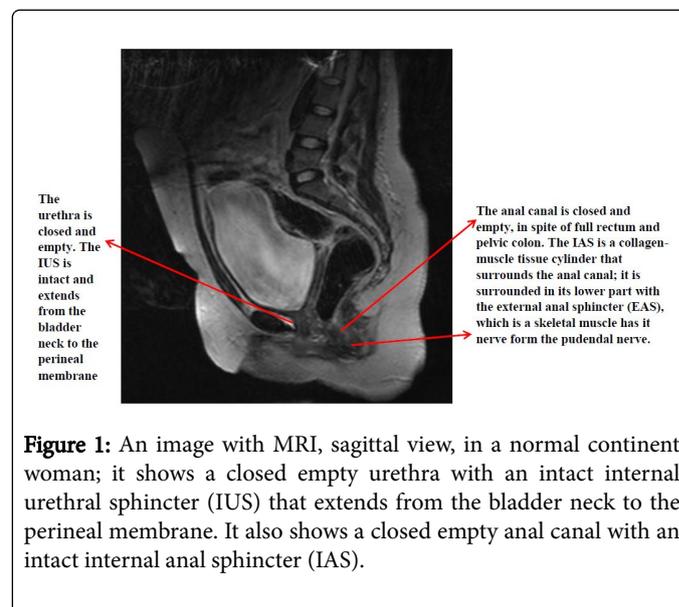


Figure 1: An image with MRI, sagittal view, in a normal continent woman; it shows a closed empty urethra with an intact internal urethral sphincter (IUS) that extends from the bladder neck to the perineal membrane. It also shows a closed empty anal canal with an intact internal anal sphincter (IAS).

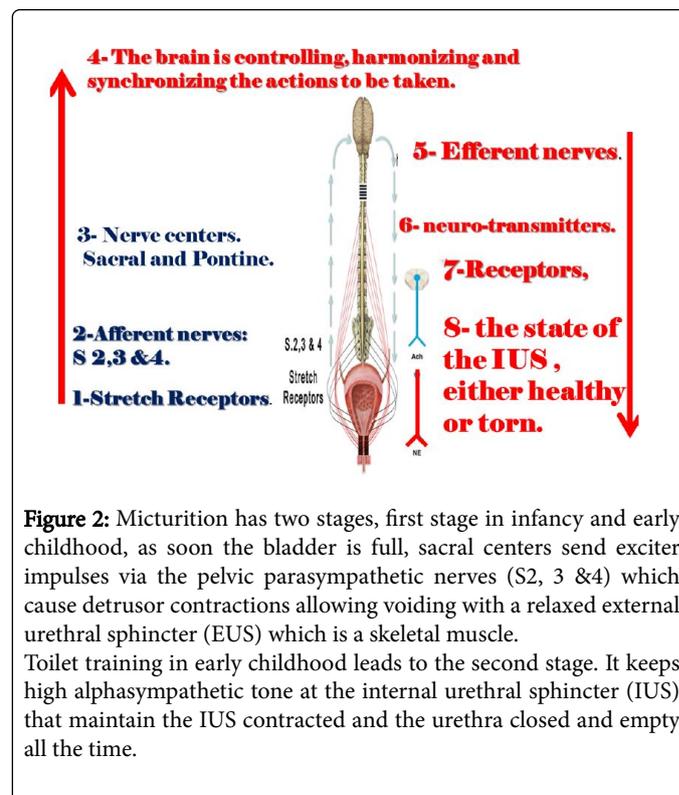


Figure 2: Micturition has two stages, first stage in infancy and early childhood, as soon the bladder is full, sacral centers send exciter impulses via the pelvic parasympathetic nerves (S2, 3 &4) which cause detrusor contractions allowing voiding with a relaxed external urethral sphincter (EUS) which is a skeletal muscle. Toilet training in early childhood leads to the second stage. It keeps high alphasympathetic tone at the internal urethral sphincter (IUS) that maintain the IUS contracted and the urethra closed and empty all the time.

The IUS is a collagen-muscle tissue cylinder that extends from the bladder neck down to the perineal membrane. The collagen gives the sphincter its high wall tension. The muscle has its nerve supply is from the thoraco-lumbar alpha sympathetic nerves T10-L2.

After toilet training, a gained high alpha sympathetic tone keeps the IUS contracted and the urethra closed and empty all the time until there is a need or a desire to void in favorable circumstances.

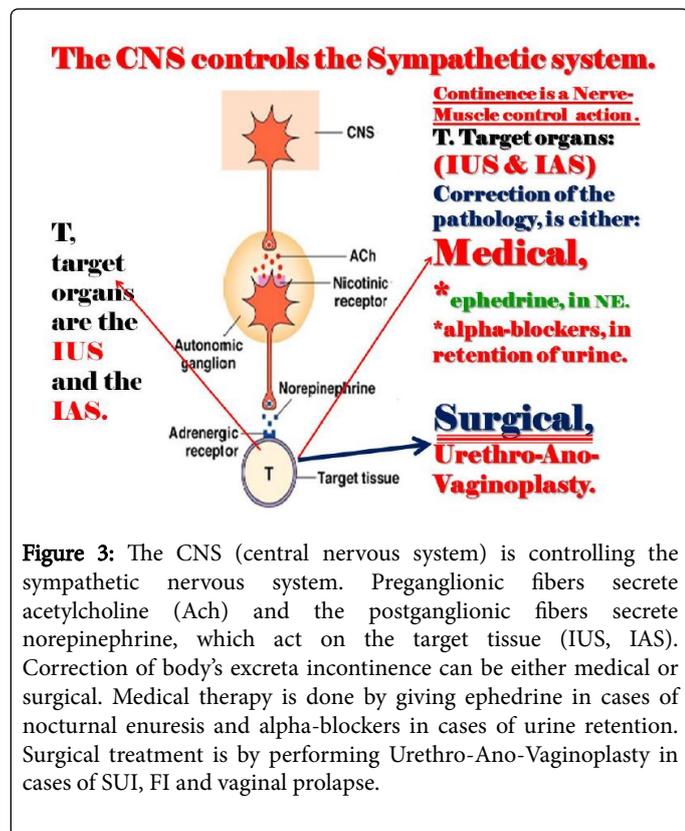


Figure 3: The CNS (central nervous system) is controlling the sympathetic nervous system. Preganglionic fibers secrete acetylcholine (ACh) and the postganglionic fibers secrete norepinephrine, which act on the target tissue (IUS, IAS). Correction of body's excreta incontinence can be either medical or surgical. Medical therapy is done by giving ephedrine in cases of nocturnal enuresis and alpha-blockers in cases of urine retention. Surgical treatment is by performing Urethro-Ano-Vaginoplasty in cases of SUI, FI and vaginal prolapse.

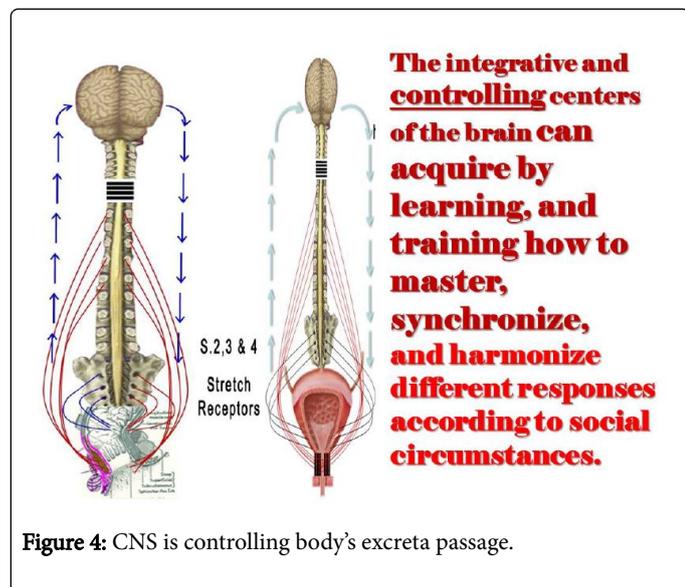


Figure 4: CNS is controlling body's excreta passage.

The IUS in women is intimately lying on the anterior vaginal wall. In men, the prostate surrounds its upper part and that increases the urethral pressure. Sensations of bladder fullness travel along the pelvic sensory nerves (S 2, 3 and 4) to the CNS. This allows the person, according to the social circumstances available, to choose either to retain the urine to a later time until favorable social circumstances

allow, or to void. If the person chooses to retain, three neuromuscular actions take place:

1. Increase of the alpha-sympathetic tone to the IUS confirming closure of the urethra.
2. The second action is to inhibit the parasympathetic impulses to the detrusor muscle inhibiting its contractions.
3. The third action is to increase of the tone of the external urethral sphincter (EUS) which is a skeletal muscle innervated by voluntary NS.

When appropriate time and place are available then, controlled by the CNS, synergistic actions between the somatic and the autonomic nervous systems four neuromuscular actions take place:

1. Is to lower the high alpha-sympathetic tone at the IUS, thus relaxing the sphincter and opening the urethra,
2. Is to relax the EUS, which is a striated muscle, innervated by somatic nerve supply,
3. Is to activate the pelvic parasympathetic nerves (S. 2, 3 &4), this lead to contraction of the detrusor muscle and empty the UB,
4. The EUS (compressor urethrae) contracts to propagate and propel the stream of urine and at the end to squeeze the urethra to expel the last drops of urine.

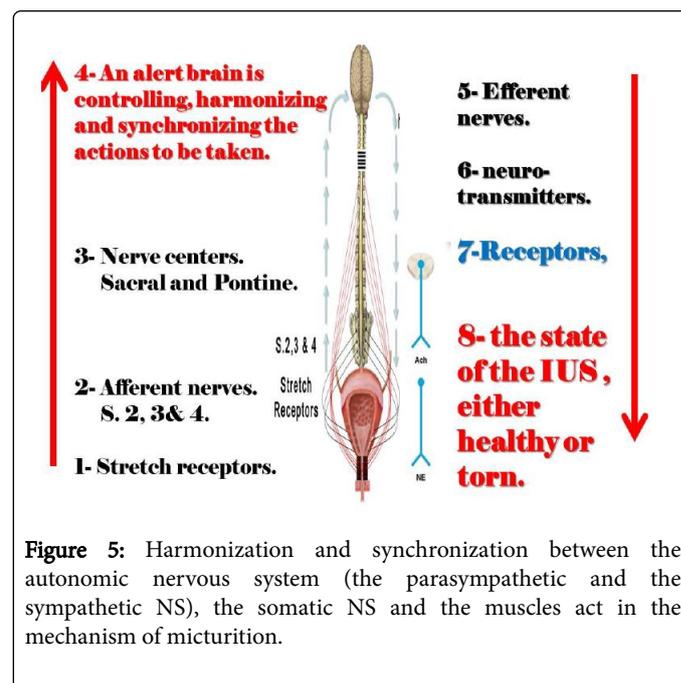


Figure 5: Harmonization and synchronization between the autonomic nervous system (the parasympathetic and the sympathetic NS), the somatic NS and the muscles act in the mechanism of micturition.

The anterior vaginal wall is subjected to childbirth trauma (CBT) which may lead to invisible lacerations in its chasis causing its laxity and subsequent prolapse. The same trauma (CBT) affects the IUS because of the intimate relation of the IUS to the anterior vaginal wall.

Injury and lacerations of the IUS lead to its weakness and it will not be able to stand against sudden rise of abdominal pressure and urine will leak, stress urinary incontinence (SUI). The commonest cause of lacerations of the IUS is vaginal deliveries [8-22](Defecation: Figures 1, 3, 4 and 6).

There are two (2) stages of the mechanism of defecation:

First stage (in infancy and early childhood) before toilet training: Sensations of full rectum travel along the pelvic sacral nerves S. 2, 3 and 4 to the sacral spinal nerve centers, excite para-sympathetic impulses along the pelvic para-sympathetic initiate defecation through relaxed anal sphincter.

Second stage after toilet training: The mother starts to teach her child how to control himself. This is gained by maintaining high alpha sympathetic tone at the IAS keeping it closed all the time until appropriate place and time are available.

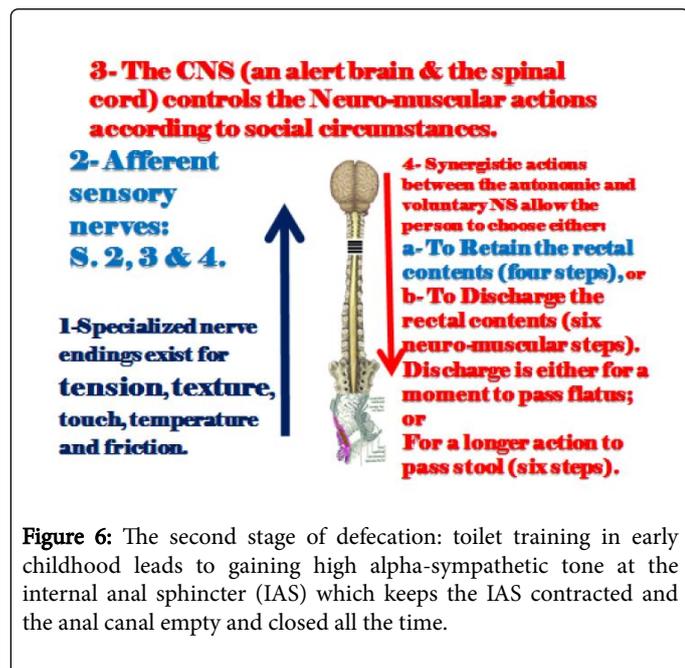


Figure 6: The second stage of defecation: toilet training in early childhood leads to gaining high alpha-sympathetic tone at the internal anal sphincter (IAS) which keeps the IAS contracted and the anal canal empty and closed all the time.

Wherever appropriate place is available and there is a desire to defecate; then under the control of the high CNS centers, through synergistic nervous actions between the Autonomic and the Voluntary N. Systems, six (6) neuro-muscular actions will occur:

- The person will lower the acquired high alpha sympathetic tone at the IAS relaxing the sphincter.
- Through, Voluntary N.S., he will relax the EAS (which is a skeletal muscle innervated by the pudendal nerve).
- Through the Voluntary N.S. He will relax the levator ani muscles, thus he will widen the acute Ano-Rectal angle (changing it to obtuse), to bring the anal canal and the rectum on one axis. Then, synergistic actions between the voluntary and autonomic nervous systems follow:
 - The abdominal and diaphragmatic muscles contract, thus, increasing the intra- abdominal pressure and forcing the feces through the anal canal. (Is done through the voluntary nervous system).
 - The smooth muscles of the distal colon and rectum contract, propelling the feces into the anal canal. (Is done through the autonomic nervous system).
 - Sequential contractions of the EAS (deep, then superficial, then the subcutaneous parts) will squeeze the anal canal propelling any residual contents.

If the circumstances are not suitable, and he chooses to retain,

- He increases the high alpha-sympathetic tone, thus confirming closure of the anal canal.
- He inhibits pelvic para-sympathetic activity.
- He induces pelvic floor muscle contraction to accentuate the ano-rectal angle.
- He increases the tone of the EAS.

The Internal Anal Sphincter (IAS) is a collagen-muscle tissue cylinder that surrounds the anal canal innervated by alpha-sympathetic nerve supply from the hypogastric nerves (T10-L2). It is surrounded in its lower part by the EAS which is a striated muscle innervated by the pudendal nerve. The IAS, if healthy, keeps the anal canal empty and closed all the time. Injury and lacerations of the IAS causes its weakness and will not resist against sudden rise of abdominal pressure and leak of flatus and/or stool will ensue, fecal incontinence (FI). The commonest causes of injury are vaginal deliveries and anal intercourse 8 and 11.

Conclusion

Continence is an acquired behavior gained by teaching, learning and training. It is how the person can control his/her sympathetic nervous system controlled by sound alert brain and CNS.

We gain high alpha-sympathetic tone at the IAS and the IUS early in childhood from toilet training.

Provoking stimulus excites the sympathetic nervous system to “fight or flight” response. Teaching and training modifies the response to holding back (continence). However, if the insult is overwhelming, there will be sympathetic failure and incontinence.

References

1. El Hemaly AKM (1998) Nocturnal Enuresis: Pathogenesis and Treatment. *Int Urogynecol J Pelvic Floor Dysfunct* 9: 129-131.
2. El Hemaly AKM (2010) Nocturnal Enuresis: A Novel Concept on its pathogenesis and Treatment.
3. El Hemaly AKM (1998) Nocturnal Enuresis: An Update on the pathogenesis and Treatment. *Int Urogynecol J Pelvic Floor Dysfunct* 9: 129-131.
4. El Hemaly AKM, Mousa L, Kandil I (2014) Continence and Incontinence: How Can You Gain Continence? Scholars press.
5. El Hemaly AKM, Kandil IM, El Mohamady BE (2011) Menopause and Voiding troubles.
6. El Hemaly AKM, Kandil IM, Rizk MA (2010) Urethro-plasty, a Novel Operation based on a New Concept, for the Treatment of Stress Urinary Incontinence, S.U.I., Detrusor Instability, D.I., and Mixed-type of Urinary Incontinence.
7. Kandil IM, El Hemaly AKM, Radwan MM (2002) Ultrasonic Assessment of the Internal Urethral Sphincter in Stress Urinary Incontinence. *The Internet Journal of Gynecology and Obstetrics* 2: 1-7.
8. El Hemaly AKM, Mousa LAES, Kandil IM, Shehata KA (2014) Imaging of the Pelvic Floor. *Current Medical Imaging Reviews* 10: 205-214.
9. El Hemaly AKM, Mousa LAES, Kandil IM, Al-Adwani AKA (2014) Pelvic Floor Dysfunction and its Reconstructive Surgery: Novel Concepts. *Createspace*.
10. El Hemaly AKM, Mousa LAES, Kandil IM (2014) Micturition and Urinary Incontinence. *Journal of Nephrology and Urology Research* 2: 19-26.
11. El Hemaly AKM, Mousa LAES, Kandil IM, Al-Adwani AKA (2013) In Pelvic Floor Dysfunction And Its Surgical Treatment: Novel Concepts On

-
- Pelvic Organs Dysfunction And Their Reconstructive Surgery. Al Ahram Publication Ltd.
12. El Hemaly AKM, Mousa LAES, Kurjak A, Kandil IM, Serour AG (2013) Pelvic Floor Dysfunction, the Role of Imaging and Reconstructive Surgery. *Donald School Journal of Ultrasound in Obstetrics and Gynecology* 7: 86-97.
 13. El Hemaly AKM, Kandil IM, Kurjak A, Mousa LAES, Kamel HH, et al. (2011) Ultrasonic Assessment of the Urethra and the Vagina in Normal Continent Women and Women Suffering from Stress Urinary Incontinence and Vaginal Prolapse. *Donald School Journal of Ultrasound in Obstetrics and Gynecology* 5: 330-338.
 14. El Hemaly AKM, Mousa LAES, Kandil IM, El Sokkary FS, Serour AG, et al. (2010) Surgical Treatment of Stress Urinary Incontinence, Fecal Incontinence and Vaginal Prolapse By A Novel Operation "Urethro-Ano-Vaginoplasty". *Gynaecologia Et Perinatologia* 19: 129-188.
 15. El Hemaly AKM, Kandil IM, Mousa LAES (2010) Urethro-vaginoplasty: an innovated operation for the treatment of: Stress Urinary Incontinence (SUI), Detrusor Overactivity (DO), Mixed Urinary Incontinence and Anterior Vaginal Wall Descent.
 16. El Hemaly AKM, Kandil IM, Radwan MM (2000) Urethro-raphy a new technique for surgical management of Stress Urinary Incontinence. *Int J Gynaecol Obstet* 70: D46.
 17. El Hemaly AKM, Kandil IM, Rizk MA, Maksoud HNA, Radwan MM, et al. (2010) Urethro-raphy The New Operation for the treatment of stress urinary incontinence, SUI, detrusor instability, DI, and mixed-type of urinary incontinence; short and long term results.
 18. El Hemaly AKM, Mousa LA (1996) Micturition and Urinary Continence. *Int J Gynecol Obstet* 52: 291-292.
 19. El Hemaly AKM (2010) Urinary incontinence in gynecology, a review article.
 20. El Hemaly AKM, Mousa LAE (1996) Stress Urinary Incontinence, a New Concept. *Eur J Obstet Gynecol Reprod Biol* 68: 129-135.
 21. El Hemaly AKM, Kandil IM (2011) Stress Urinary Incontinence SUI facts and fiction. Is SUI a puzzle?!
 22. El Hemaly AKM, Maksoud NA, Mousa LA, Kandil IM, Anwar A, et al. (2011) Evidence based Facts on the Pathogenesis and Management of SUI. *Psychiatric Times*.