W3: Debates and Controversies on Autonomic Dysreflexia After Spinal Cord Lesion

Workshop Chair: Christina-Anastasia Rapidi, Greece
12 September 2017 07:30 - 08:30

Start	End	Topic	Speakers
07:30	07:40	AD Episodes Treated: Easily If Diagnosed In Time	Christina-Anastasia Rapidi
07:40	07:50	AD Episodes Treated: Difficultly Due to Intractable Detrusor Overactivity (Management of AD With Intravesical Botulinum Toxin Injections)	Andrei Krassioukov
07:50	08:00	Medically Induced AD: A Useful Effect in Order To Specify The Threshold and Severity of AD Episodes and Educate Patients.	Helmut Mandersbacher
08:00	08:10	Sexual Health & AD: Sexual Activity, a Factor Inducing AD Episodes	Charalampos Konstantinidis
08:10	08:20	Sexual Health & AD: AD- a Syndrome Mimicking Orgasm?	Pierre Denys
08:20	08:30	Discussion	All

Speaker Powerpoint Slides

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Aims of Workshop

Autonomic dysreflexia (AD) can occur in anyone with SCI at or above the sixth thoracic neurotome. It is a potentially life-threatening acute condition due to an excessive, uncontrolled, sympathetic output in response to a noxious or no noxious stimulus below the level of injury.
The aim of this workshop is to shed light on controversies concerning AD. How difficult is the management of an AD episode? Are there cases of induced AD episodes which are “acceptable” or not? How should we educate patients prone to suffer AD episodes? Sexual health and AD episodes.

Learning Objectives

How to manage autonomic dysreflexia episodes.
How to assess autonomic dysreflexia episodes and educate patients with spinal cord injury.
Interactions between sexual life and autonomic dysreflexia episodes.

Learning Outcomes

Recognizing the symptoms and sighs of an autonomic dysreflexia episode.
The proper management of autonomic dysreflexia episodes.
Understanding the different aspects of autonomic dysreflexia episodes.

Target Audience

Rehabilitation team working with patients with spinal cord injury, physicians and therapists.

Advanced/Basic

Advanced

Conditions for Learning

It is an interactive course with short lectures and time for discussion.

Suggested Learning before Workshop Attendance

E-learning of ISCoS http://www.elearnsci.org/ concerning autonomic dysreflexia

Suggested Reading

2001, Consortium for Clinical Practice Guidelines for Acute management of AD, by Paralyzed Veterans of America.
http://www.isaarsci.ir/internetscifolder/Acute%20Management%20of%20Autanamic%20Dysreflexia.PDF

"AD Episodes Treated: Easily If Diagnosed In Time"

Christina-Anastasia Rapidi, Physical Medicine and Rehabilitation, Greece, rapidicha@hotmail.com
PRM Department, General Hospital "G.Gennimatas", Athens, Greece, Vice President of the Hellenic Society of PRM, President of the SCI Section of the Hellenic Society of PRM, Chair of Special Interest Scientific Committee for SCI of European Society of PRM, golden member of ICS

Tetraplegia or high paraplegia due to spinal cord injury (SCI) is associated with significant dysfunction not only of the somatic nervous system but the autonomic nervous system too. This dysfunction mainly refers to the sympathetic nervous system and not to the parasympathetic nervous system, which in a significant portion bypasses spinal cord through the X cranial nerve.

Episodes of AD can occur in anyone with a SCI at or above the sixth thoracic neurotome. It is a potentially life-threatening acute condition due to an excessive, uncontrolled sympathetic output in response to a noxious or no noxious stimulus below the level of injury. Bladder distention usually induce AD in patients with high paraplegia or tetraplegia.

The AD is also reported in the literature as paroxysmal hypertension, paroxysmal neurogenic hypertension, sympathetic hyperreflexia, autonomic spasticity, autonomic hyperreflexia, hyperactive autonomic reflexes, paroxysmal hyperactive autonomic reflexes, spinal poikilopiesis, autonomic reflex, mass reflex, neurovegetative syndrome of bladder vesical distension. *(1948, Thompson and Witham; 1976, Mathias et al; 1993, Young; 1986, McGuire and Kumar)*

The diagnosis of AD will be raised with the sudden, significant increase in both the systolic and diastolic blood pressure above their usual levels, frequently associated with bradycardia. Persons with SCI above T6 have normal/baseline systolic blood pressure in the 90-110 mm Hg range. Systolic blood pressure elevations more than 20 mm to 40 mm Hg above baseline may be a sign of AD. Elevations more than 15-20 mm Hg above baseline in adolescents with SCI or more than 15 mm Hg in children with SCI may be a sign of AD. *(2001, Consortium for Clinical Practice Guidelines for Acute management of AD, by Paralyzed Veterans of America)*

The AD occurrence varies in literature, and reaches up to 90% in persons with SCI at or above T6 neurotome. Episodes of AD occur post spinal shock in the chronic phase of SCI. This does not exclude the occurrence of AD episodes during the acute phase, or even in lesions at more caudal neurotomes than T6. *(2003, Krassioukov AV, et al. J Neurotrauma; 2000, Silver JR. Spinal Cord; 1975, Corbett et al; 1980, Lindan ; 1993, Mathias and Frankel; 1995, Lee et al; 1998, Giannantoni et al; 1998, Vaidyanathan et al; 1999, Karlsson)*

The early diagnosis and management of AD, leads to the easiest resolution of the emergency.

Sitting the person up, loosening any clothing or constrictive devices, monitoring the blood pressure and pulse frequently, checking the bladder and emptying it, checking for other causes of AD and resolve them, like faecal impaction, injuries that were not perceived, etc., resolves the problem in most AD episodes.

Unfortunately, it is not always possible to start the above algorithm of AD management in time, either because the person himself is unaware of the symptoms of this condition, or the health staff does not recognize AD, or it is a "silent" AD episode without symptoms. In this case, the AD episode that is not treated promptly leads to a peak of the symptoms and a further increase in arterial pressure and life threatening complications.

Another reason for inadequate treatment is the inability to recognize the underlying cause of AD. In this

case, the treatment should be symptomatic, namely the control of arterial pressure even by intravenous administration of antihypertensive in the intensive unit, or anaesthesia of the patient.

If diagnosed in time, AD episodes are treated easily, and are self-limited after the removal of the underlying initial stimuli. The proper education of the person with SCI and her/his family and care givers, the proper awareness of health personnel, and the balanced functioning of the neurogenic bladder and bowel contribute greatly in this direction.

"AD Episodes Treated: Difficultly Due to Intractable Detrusor Overactivity (Management of AD with Intravesical Botulinum Toxin Injections)"

Andrei Krassioukov, Physical Medicine and Rehabilitation, Canada, krassioukov@icord.org

Associate Director and Scientist, ICORD, Director of Autonomic Research Unit, Staff physician, Spinal Cord Program, GF Strong Rehabilitation Centre, University of British Columbia, Adjunct Professor, Dep. Phys. Med. & Rehab.University of Western Ontario, London, ON

Autonomic dysreflexia (AD) is a medical emergency that commonly occurs in individuals with high thoracic and cervical spinal cord injury (SCI). The most common triggers for this condition typically localized within the urinary bladder (bladder distension, involuntary detrusor contractions, and urinary tract infections). Previously self-reported AD was reduced following OnabotulinumtoxinA (Allergan) treatment for neurogenic detrusor over activity; however, none of the previous studies have assessed AD events using the clinical cut-off of an increase in systolic blood pressure ≥20 mmHg.

We recently conducted study used a prospective, open-labelled design to quantitatively assess the efficacy of one cycle 200 units intra-detrusor injected OnabotulinumtoxinA (20 sites) on reducing the severity and frequency of bladder-related AD events and improving quality of life of these individuals. Forty individuals with chronic, traumatic SCI at or above the sixth thoracic spinal cord level, and concomitant AD and neurogenic detrusor over activity underwent blood pressure monitoring during urodynamics and over a 24-h period using ambulatory blood pressure monitoring pre and one month post treatment.

Post-OnabotulinumtoxinA, AD severity was reduced during urodynamics (systolic blood pressure increase: 42±23 mmHg vs. 20±10 mmHg, $p<0.001$) and during bladder-related events across the 24-h period (systolic blood pressure increase: 49±2 mmHg vs. 26±22 mmHg, $p=0.004$). Frequency of 24-h bladder-related AD events was also decreased post-OnabotulinumtoxinA (4±2 events vs. 1±1 events, $p<0.001$). Bladder functions and incontinence quality of life indices were also improved post-OnabotulinumtoxinA ($p<0.05$).

Our study demonstrated that intra-detrusor injections of OnabotulinumtoxinA for the management of neurogenic detrusor over activity in individuals with high level SCI decreased the severity and frequency of bladder-related episodes of AD, and improved bladder function and quality of life. Supported by Rick Hansen Institute and Allergan.

"Medically Induced AD: A Useful Effect in Order to Specify the Threshold and Severity of AD Episodes and Educate Patients"

Helmut Mandersbacher, Urologist, Austria, helmut.madersbacher@tirol-kliniken.at

Professor of Neuro-Urology, President of INUS

In 75-90% of patients, episodes of autonomic dysreflexia (AD) are triggered by events located in the lower urinary tract (LUT) and in the bowels. These events can also be iatrogenic, caused by urological procedures and bowel evacuation management.

Already in 1996 Linsenmeyer et al. found urodynamics as an excellent tool in detecting both symptomatic and silent AD in men with SCI above D6 [1]. Research activities in the last years yielded important new insights about the frequency and severity of AD triggered by diagnostic and therapeutic interventions in the LUT and in the bowels such as urodynamics, cystoscopy, transurethral litholopaxie, ESWL, sperm retrieval, digital rectal evacuation and transanal irrigation. Based on these findings, threshold and severity of AD episodes, which are different with different interventions, can be interpreted in a better way. This allows a better assessment of the risk for AD thus improving counseling of the patient.

The incidence of AD varies mainly according to the density of receptors stimulated. The receptor density is high in the area of the bladder neck, prostate and posterior urethra and in the anal canal, but less in the bladder and the colon. AD is reported with urodynamics in-between 45-78%, with cystoscopy in 80% in cervical and less frequent, in 24-77% resp. 10-40%, in thoracic lesions above D6.

As urodynamics are performed more often than cystoscopies in SCI patients, they are an important screening tool for AD. Curt et al. (1997) described urodynamic examination as an effective and standardized diagnostic procedure for provoking signs of AD [2]. In their study only half of the patients, who showed signs of AD during an examination, presented also with clinical symptoms, the other half had "silent" AD, only diagnosed at the basis of systolic blood pressure (sBP) increase. According ISAFSCI criteria the primary characteristic of AD includes the minimum sBP increase of 20 mmHg from baseline [3]. Therefore, cardiovascular monitoring is a prerequisite to detect AD using urodynamics as a screening test.

The increase in sBP was also used to compare the severity of AD between urodynamics and cystoscopy. The sBP change was greater during cystoscopy than in urodynamics, indicating that stimulation of the bladder neck, urethra and prostate area is more potent than just bladder filling. On the other side, if urodynamics cause severe sBP increase the risk to react with AD in other situations is high.

Also bowel management may cause AD. The increase in sBP is low with transanal irrigation compared to digital rectal evacuation in which the increase in sBP is comparable to that with cystoscopy [4]. As two thirds of SCI patients use digital anorectal stimulation for bowel evacuation, at least those with significant AD should use transanal irrigation instead. [5]

The occurrence of AD episodes in connection with diagnostic and therapeutic procedures in the LUT and in the bowels can be used as an excellent tool in detecting both symptomatic and silent AD in patients with SCI above D6. Recent studies in this field allow nowadays better interpretation of these findings regarding the risk for AD, thus also counseling of the patient is improved.

References

[1] Linsenmeyer et al., J Urol 1996
[2] Curt et al. J Neurol Neurosurg Psychiatry 1997
[3] Krassioukov et al., J Spinal Cord Med 2012
[4] Faaborg et al, Spina Cord 2014
[5] Liu et al., Spinal Cord 2015

"Sexual Health & AD: Sexual Activity, a Factor Inducing AD Episodes"

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Autonomic Dysreflexia (AD) is a common complication among patients with spinal cord lesion located above T6 level. Noxious or even not noxious stimuli below the spinal cord lesion may initiate the onset of AD. Bladder distention or bowel impaction, are the most common stimuli which cause AD. Pressure ulcers, toenails into the skin or other wounds may be the responsible factors for AD, as well. In the majority of these

cases, the phenomenon is self-limited and subsides after the removal of the initial stimuli. Sexual activity and stimulation of the genitalia can also lead to AD. On the other hand, sexual activity is very important for the QoL of paraplegic and tetraplegic patients, which improves their wellbeing, in emotional and in a somatic way, as well. Especially, spasticity is usually get improved after sexual activity.

Ejaculation, which is a very powerful sympathetic mediated phenomenon very often may induce AD. In some patients, ejaculation not only provokes AD but drives to "malignant" AD. This is a severe AD with a tendency of progressive worsening even when the alleviating factor is removed and maintains for a prolonged time, from some hours to a week or more. According to the limited existing data in the literature, this kind of AD is the outcome of a complete disruption of the sympathetic pathways (as it is demonstrated by Sympathetic Skin Responses - SSRs) in addition to excessive sympathetic stimulation which takes place during ejaculation. The prolonged period of the phenomenon can be explained by the hypothesis of urethral damage (disruption of urethral mucosa) during ejaculation due to high intraurethral pressure caused by semen emission in prostatic urethra accompanied by severe external sphincter dyssynergia. The distention of the prostatic urethra and a concomitant microtrauma of the mucosa can maintain the sympathetic stimulation until the healing process takes place and the sphincter decreases its contractions. Most possible candidates for malignant AD are patients with complete disruption of the sympathetic pathways, who did not experience ejaculation at the past and try sperm retrieval with vibrostimulator. Awareness of malignant AD among patients and health care professionals, during sperm retrieval, is very important for the prompt recognition and treatment.

As a take home message, we encourage our patients to involve to sexual activity, due to the potential benefits on their QoL. In AD candidates, it is important to be concerned with the phenomenon and to start their "new" sexual experience step by step until they can estimate the cut-off point of the initiation of AD, in order to stop on time, before the dysreflexia become more severe.

References:

1. Elliott S, Krassioukov A. Malignant autonomic dysreflexia in spinal cord injured men. Spinal Cord. 2006 Jun;44(6):386-92.
2. Ekland MB, Krassioukov AV, McBride KE, Elliott SL. Incidence of autonomic dysreflexia and silent autonomic dysreflexia in men with spinal cord injury undergoing sperm retrieval: implications for clinical practice. J Spinal Cord Med. 2008; 31(1):33-9.

"Sexual Health & AD: AD- a Syndrome Mimicking Orgasm?"

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Since more than 40 years, scientific literature addressed the very difficult and debatable definition of orgasm. Different definitions were described both in male and female.

Recent studies clarify the role of the spinal cord in the control of sexual function both in male and female. There is now some evidence for a spinal generator of ejaculation in men, located at the L2L4 level in men between lower thoracic sympathetic center and somatic and parasympathetic sacral centers. This spinal generator is in charge of the temporal synchronization of both autonomic and somatic spinal centers during ejaculation under the control of a supraspinal control. A similar neuronal network is present and demonstrated based on human neuroanatomical studies in female.

Ejaculation is usually impaired after a spinal cord injury and supramaximal penile vibratory stimulation can elicit ejaculation depending on the level and completeness of the lesion. In another hand persons with spinal cord may lose sensations from the sexual organs, bowel or bladder. A lot of studies addressed the impact of the lesion on erection or ability to achieve ejaculation, lubrication and orgasm.

SCI men, during ejaculation elicited by self stimulation or vibratory stimulation, describe sensation, cardiovascular and motor events. A sudden rise in systolic blood pressure, abdominal and lower limb contractures, as well as cutaneous flush. Whether these sensations built an orgasm is still a matter of debate in male patients. In high thoracic and cervical lesions the rise in blood pressure is higher.

Women's ability to achieve orgasm following SCI is well describe in the literature and globally half of the patients reported such experience even unaltered from the previous experience. Sipski describe extensively the close relation between completeness and level of the lesion and the physiological events during sexual activity including orgasm. The same type of cardiovascular, respiratory events are reported by SCI women than in able bodied population. The role of vagus nerve in vaginal sensation and orgasm was also discussed in female based on anatomical studies in animal and SCI studies.

Still a lot of questions needs to be clarified to state that AD mimics orgasm. Do the autonomic and motor events during ejaculation and orgasm are autonomic dyreflexia? Is it the same question in male and female? Are the autonomic and motor events during ejaculation built an orgasmic sensation?

Other Supporting Documents

1. Liu, N., Zhou, M., Biering-Sørensen, F., & Krassioukov, A. Iatrogenic urological triggers of autonomic dysreflexia: a systematic review. *Spinal Cord , Jul 2015; 53* (7), pp. 500-9
2. Faaborg, P., Christensen, P., Krassioukov, A., Laurberg, S., Frandsen, E., & Krogh, K.). Autonomic dysreflexia during bowel evacuation procedures and bladder filling in subjects with spinal cord injury. *Spinal Cord ,* Jun 2014;*52* (6), pp. 494-8.
3. Chéhensse C, Bahrami S, Denys P, Clément P, Bernabé J, Giuliano F. The spinal control of ejaculation revisited: a systematic review and meta-analysis of anejaculation in spinal cord injured patients. Hum Reprod Update. 2013 Sep-Oct;19(5):507-26. doi: 10.1093/humupd/dmt029. Review. PubMed PMID: 23820516
4. Krassioukov, A., Biering-Sorensen, F., Donovan, W., Kennelly, M., Kirshblim, S., Krogh, K., et al. International standards to document remaining autonomic function after spinal cord injury. *J Spinal Cord, 2012; Med , 35*, pp. 36-43
5. Rapidi CA, Petropoulou K, Galata A, Fragkaki M, Kandylakis E, Venieri M, Tzavara Ch. Neuropathic bladder dysfunction in patients with motor complete and sensory incomplete spinal cord lesion. Spinal Cord. 2008 Oct;46(10):673-8. doi:10.1038/sc.2008.16. PubMed PMID: 18317484.
6. Rapidi CA, Panourias IG, Petropoulou K, Sakas DE. Management and rehabilitation of neuropathic bladder in patients with spinal cord lesion. Acta Neurochir Suppl. 2007;97(Pt 1):307-14. Review. PubMed PMID: 17691391.
7. Elliott S, Krassioukov A. Malignant autonomic dysreflexia in spinal cord injured men. Spinal Cord. 2006 Jun;44(6):386-92. Epub 2005 Sep 27. PubMed PMID:16186856.
8. Silver JR. Early autonomic dysreflexia. Spinal Cord. 2000 Apr;38(4):229-33. Review. PubMed PMID: 10822393.
9. Hickey KJ, Vogel LC, Willis KM, Anderson CJ. Prevalence and etiology of autonomic dysreflexia in children with spinal cord injuries. J Spinal Cord Med.2004;27 Suppl 1: S54-60. PubMed PMID: 15503704
10. Krassioukov AV, Furlan JC, Fehlings MG. Autonomic dysreflexia in acute spinal cord injury: an under-recognized clinical entity. J Neurotrauma. 2003 Aug;20(8):707-16. PubMed PMID: 12965050.
11. Curt, A., Nitsche, B., Rodic, B., Schurch, B., & Dietz, V.. Assessment of autonomic dysreflexia in patients with spinal cord injury. *J Neurol Neurosurg Psychiatr*y, 1997; *62*, pp. 473-7.
12. Linsenmeyer, T., Campagnolo, D., & Chou, I. Silent autonomic dysreflexia during voiding in men with spinal cord injuries. *J Urol , 1996; 155*, pp. 519-22

W3: Debates and Controversies on Autonomic Dysreflexia After Spinal Cord Lesion

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TUESDAY 12TH SEPTEMBER 2017

07:30 - 08:30

SPADOLINI E
Capacity: 200

SPEAKERS

- **CHRISTINA-ANASTASIA RAPIDI** — WORKSHOP CHAIR
- **ANDREI KRASSIOUKOV** — WORKSHOP SPEAKER
- **HELMUT MADERSBACHER** — WORKSHOP SPEAKER
- **CHARALAMPOS KONSTANTINIDIS** — WORKSHOP SPEAKER
- **PIERRE MANUEL DENYS** — WORKSHOP SPEAKER

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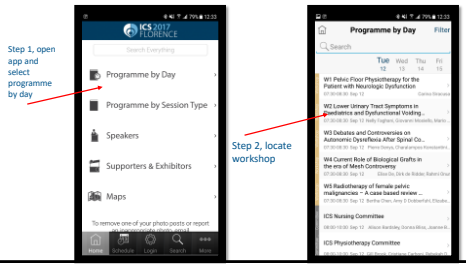

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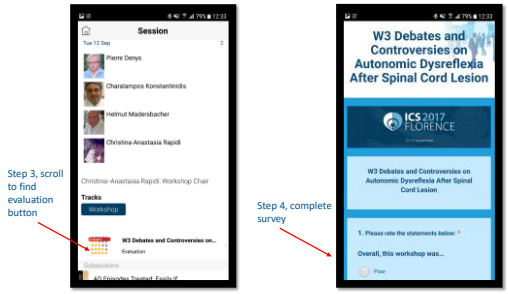

What is AD?

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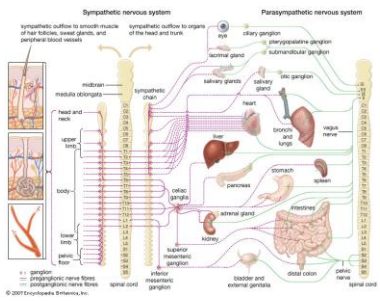

AD is a potentially life-threatening acute condition due to an excessive, uncontrolled sympathetic output, leading to excessive BP increase

Triggered by any Noxious or No-Noxious stimulus below the level of injury

AD Episodes are Easily or Difficultly Treated?

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AD Episodes are Easily Treated: If Diagnosed In Time

Dr. Christina-Anastasia-Annie RAPIDI
Physical & Rehabilitation Medicine Department
General Hospital "G.Gennimatas" , Greece

AD Episodes are Difficultly Treated: Due to Intractable Detrusor Overactivity (Management of AD with Intravesical Botulinum Toxin Injections)

Pr. Andrei KRASSIOUKOV
Physical Medicine and Rehabilitation, Canada,
Associate Director and Scientist, ICORD,
Director of Autonomic Research Unit, Staff physician, Spinal Cord Program, GF Strong Rehabilitation Centre, University of British Columbia,
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C-A.Rapidi

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Affiliations to disclose†:

Nothing to disclose

† All financial ties (over the last year) that you may have with any business organisation with respect to the subjects mentioned during your presentation

Funding for speaker to attend:

- ☐ Self-funded
- ☐ Institution (non-industry) funded
- ☒ Sponsored by: *ARITI*

AD Episodes are Easily Treated

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Easy Treatment = Early Diagnosis
High index of suspicion
Symptoms may remain minimal or absent

Episode of AD: Who-When-Why

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Rare cases: in lesions at more caudal neurotomes than T6

SCI >T6

Severity of AD is related to the higher level and completely lesion
91% of complete tetra
27% incomplete tetra

neurogenic shock

spinal shock

Autonomic dysreflexia

ACUTE PHASE → CHRONIC PHASE

Episodes of AD occur post spinal shock in the chronic phase of SCI.
Rare cases: AD episodes occur during the acute phase

2003, Krassioukov AV, et al. J Neurotrauma; 2000, Silver JR. Spinal Cord; 1975, Corbett et al; 1980, Lindan ; 1993, Mathias and Frankel; 1995, Lee et al; 1998, Giannantoni et al; 1998, Vaidyanathan et al; 1999, Karlsson

Episode of AD: Where-When-Why

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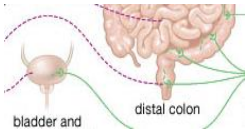
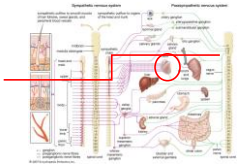
- **distension or contraction of hollow organs (85%):**
  - urine retention
  - plugged catheter
  - fecal impaction



- **activation of pain receptors:**
  - UTI
  - anal fissure
  - hemorrhoid
  - pressure sore or burn
  - ingrown toenail
  - fractures of lower limbs
  - myocardial infarction



any Noxious or No-Noxious stimulus below the level of injury

Early Diagnosis of AD:

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Recognize the **Symptoms**

- feeling of great anxiety
- pounding headache
- stuffy nose
- piloerection
- flushing & sweating above the level of injury
- paling, vasoconstriction below the level of injury (sweating sometimes)
- slow (or rapid) heart rate
- breathing difficulty
- blurring of vision
- nausea

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Early Diagnosis of AD:

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Recognize the **Signs**

Check BP

Sudden, significant* increase in both the systolic and diastolic BP above their usual levels, frequently associated with bradycardia, may be a sign of AD.

*Adults: above baseline** systolic BP >20 - 40mmHg
Adolescents: above baseline systolic BP >15 - 20mmHg
Children: above baseline systolic BP >15mmHg

Persons with SCI >T6 have normal/baseline systolic blood pressure in the **90-110mmHg range.

2001, Consortium for Clinical Practice Guidelines for Acute management of AD, by Paralyzed Veterans of America

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Severity of AD

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Mild/Partial AD episode: BP increase < 40mmHg

Moderate AD episode: SPB increase > 40mmHg, but SBP < 180mmHg

Severe AD episode: SBP increase > 180mmHg

Report of the joint committee of ASIA and the ISCoS concerning the development of assessment criteria for general autonomic function testing following SCI.

2007, Andrei V. Krassioukov, et al. J of Rehabilitation Research & Development.

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AD Episodes Treated: Easily If Diagnosed In Time

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High index of suspicion is needed

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Episode of AD: Where-When-**Why**

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Not so common noxious stimuli, recurrent symptoms at posture change:

- Syringomyelia (symptomatic PTS 4%)

C6, AIS A male (29years ago): last 2 months profuse sweating and flushing of the right half of the face and neck, when lying in supine and left lateral positions

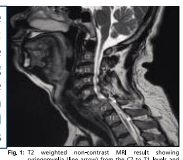

Fig. 1: T2 weighted non-contrast MRI result showing syringomyelia (line arrow) from the C7 to T1 levels and the presence of old vertebrae fractures (C5 & C6) with cord transection. *2012, S S Sudin, et al.*

Episode of AD: Where-When-**Why**

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Not so common noxious stimuli, recurrent symptoms at posture change:

- Disco-vertebral lesion below injury level
- Charcot arthropathy

- **Unexplained AD episodes need thorough check-up**
- **Correct diagnosis of underlying triggering cause leads to AD treatment**

C6, AIS A female (3 years ago) Ankylosing spondylitis last 5months sweating, severe headache and very high blood pressure recurrent postural AD

2016), A Barman, et al

C6, AIS A male (41 years ago) Charcot spinal arthropathy L1-L2 Spinal fusion and antibiotic treatment Last 6months,

2016 Zyck et al.

AD Episodes Treated: Easily If Diagnosed In Time

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Educate

Patients & Caregivers

Health professionals (not SCI specialists)

AD Medical Emergency Card

- **National language & English**
- **Endorsed by Scientific Committees of National & International Societies**
- **… individualized information & history of AD episodes**

Easy Treatment = Early Diagnosis = Knowledge

The importance of ISAFSCI

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International Standards for the Assessment of Autonomic Function after Spinal Cord Injury

identifying susceptible persons for AD

AUTONOMIC STANDARDS ASSESSMENT F… Patient Name:…

General Autonomic Function

System/Organ	Findings	Abnormal con…
Autonomic control of the heart	Normal	
	Abnormal	Bradycardia
		Tachycardia
		Other dysrhythr…
	Unknown	
	Unable to assess	
Autonomic control of blood pressure	Normal	
	Abnormal	Resting supine blood pressure below 90 mmHg
		Orthostatic hypotension
		Autonomic dysreflexia
	Unknown	
	Unable to assess	
Autonomic control of sweating	Normal	
	Abnormal	Hyperhydrosis above lesion
		Hyperhydrosis below lesion
		Hypohydrosis below lesion
	Unknown	
	Unable to assess	
Temperature regulation	Normal	
	Abnormal	Hyperthermia
		Hypothermia
	Unknown	
	Unable to assess	
Autonomic and somatic control of Bronchy-pulmonary System	Normal	
	Abnormal	Unable to voluntarily breathe requiring full ventilatory support
		Impaired voluntary breathing requiring partial vent support
		Voluntary respiration impaired does not require vent support
	Unknown	

y Tract, Bowel and Sexual Function

Tract	Score
to need to empty the bladder	
n leakage (continence)	
ig method	
Bowel	
Sensation of need for a bowel movement	
Ability to Prevent Stool Leakage (Continence)	
Voluntary sphincter contraction	
Sexual Function	
Genital arousal (erection or lubrication) — Psychogenic	
Reflex	
Orgasm	
Ejaculation (male only)	
Sensation of Menses (female only)	

2 = Normal function, 1=Reduced or Altered Neurological Function
0=Complete loss of control NT=Unable to assess due to preexisting or concomitant problems

Urodynamic Evaluation

System/Organ	Findings	Check mark
Sensation during filling	Normal	
	Increased	
	Reduced	
	Absent	
Detrusor Activity	Non-specific	
	Normal	
	Overactive	
	Underactive	
Sphincter	Normal	
	Normal urethral closure mechanism	
	Normal urethral function during voiding	
	Incontinence	
	Detrusor sphincter dyssynergia	
	Urethral/voiding sphincter	

Date of Injury_____ Date of Assessment_____ Examiner_____

This form may be freely copied and reproduced but not modified (Sp Cord, 2009, 47, 36-43)
This assessment should use the terminology found in the International SCI Data Set (ASIA and ISCoS - http://www.asia-spinalinjury.org/bulletinBoard/dataset.php)

AD: What to do? How **to treat? Easily?**

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Initially nonpharmacologic measures

- Sit patient upright (not lying down)
- Monitor blood pressure (BP) ever…n
- **Find and eliminate the trig…**

Prevention of stimuli

Good management of:
Bladder
Bowel
Skin
Musculo-skeletal health

if SBP remains elevated, s…e type of pharmacologic agent should be initiated :
>150mmHg in an adult
>140mmHg in an adolescent
>130mmHg in a child 6 to 12y
>120mmHg in a child under 5y

2009, A Krassioukov, et al. 1991, RL Braddom, et al. 2001, Consortium for Clinical Practice Guidelines for Acute management of AD, by Paralyzed Veterans of America

AD Episodes Treated: Easily If Diagnosed In Time

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Find the cause and resolve it, **but:**

- The phenomenon of "silent" AD which is: raised BP without other symptoms, may mislead early diagnosis
- continuous versus intermittent monitoring are more likely to report greater changes in systolic blood pressure

Incidence of AD episodes may be under-estimated

**2013, Y-H Huang, et al. 2008, Marci B. Ekland, et al. 2016, R Davidson, et.al, J NEUROTRAUMA*

5th SEPTEMBER WORLD SCI DAY YES, WE CAN 2017

Take home message

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Treatment of Autonomic Dysreflexia is Easy *under special conditions*

AD episodes are self-limited
If diagnosed in time
and
after the removal of the underlying stimuli

W3: Debates and Controversies on Autonomic Dysreflexia After Spinal Cord Lesion

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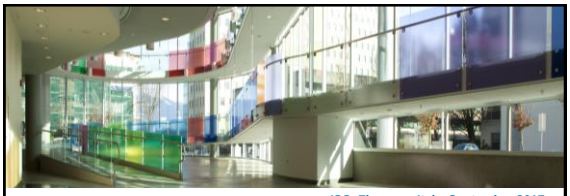
Discussion

AD Episodes Treated: Easily If Diagnosed in Time	Christina-Anastasia Rapidi
AD Episodes Treated: Difficultly Due to Intractable Detrusor Overactivity (Management of AD with Intravesical Botulinum Toxin Injections)	Andrei Krassioukov
Medically Induced AD: A Useful Effect in Order to Specify the Threshold and Severity of AD Episodes and Educate Patients.	Helmut Mandersbacher
Sexual Health & AD: Sexual Activity, a Factor Inducing AD Episodes	Charalampos Konstantinidis
Sexual Health & AD: AD- a Syndrome Mimicking Orgasm?	Pierre Denys



ISC, Florence, Italy, September 2017

Autonomic Dysreflexia due to intractable detrusor overactivity. Management of Autonomic Dysreflexia with intravesical botulinum toxin injections.

Andrei Krassioukov MD, PhD, FRCPC
Professor, Div. Physical Medicine & Rehabilitation,
Chair Rehabilitation Medicine
Scientist and Associate Director ICORD,
Department of Medicine
University of British Columbia, Vancouver, BC

Disclosure

Research support

- Canadian Institute of Health Research (CIHR)
- Canadian Foundation for Innovation (CFI)
- Heart and Stroke Foundation of Canada
- Rick Hansen Institute & Foundation
- Crag H. Nielsen Foundation
- Cristopher and Dana Reeve Foundation
- Department of Defence (DOD, USA)
- Wings for Life
- Pfizer
- Allergan
- Purdue

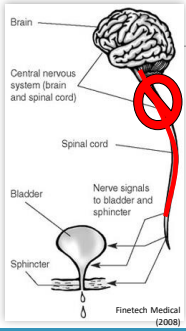
Advisory boards

- Coloplast: Urinary Tract Infections Advisory Board
- Wellspect: Management of neurogenic bowel Advisory Board
- Craig H. Nielsen Foundation: Bladder and Bowel working group

Objectives

- To present evidence on connections between urinary bladder dysfunctions and autonomic dysreflexia following spinal cord injury.
- To present latest evidence on management of autonomic dysreflexia related to urinary bladder overactivety.

What happens to the bladder after SCI?



Significant disruption **in the communication pathways between the bladder and the brain**

Neurogenic Detrusor Overactivity (NDO)

- Hyper-reflexive/spastic
- Involuntary bladder contractions
- Urinary bladder incontinence
- **Autonomic dysreflexia (AD)**

Blood pressure changes with visceral stimulations fo

ORIGINAL ARTICLE

Autonomic dysreflexia severity during and cystoscopy in individuals with sp

- 63.2% presented with increase BP>20 mmHg, meeting the crit urodynamics.
- Average increase in SBP durin **51.8±21.8 mmHg**.

ORIGINAL ARTICLE

Autonomic dysreflexia during bowel evacuation procedures and bladder filling in subjects with spinal cord injury

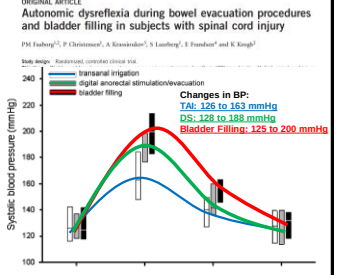
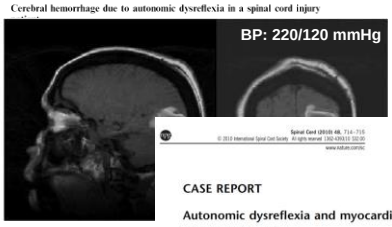


Figure 1 Systolic blood pressure (median and range) during bladder filling (black), transanal colorectal irrigation (white) and digital anorectal stimulation/evacuation (gray) in subjects with high SCI. Results are given for baseline, maximum stimulation (Max.stim.), 3 min after maximum stimulation (+3 min) and 12 min after maximum stimulation (+12 min). The boxes are displayed slightly offset for better reader friendliness.

Should we worry about AD due to bladder irritation?

Case Report

Cerebral hemorrhage due to autonomic dysreflexia in a spinal cord injury



BP: 220/105 mmHg

CASE REPORT

Autonomic dysreflexia and myocardial ischemia

Previous Literature- Self Report Only: AD

BOTULINUM-A TOXIN FOR TREATING DETRUSOR HYPERREFLEXIA IN SPINAL CORD INJURED PATIENTS: A NEW ALTERNATIVE TO ANTICHOLINERGIC DRUGS? PRELIMINARY RESULTS

B. SCHURCH,* M. STÖHRER, G. KRAMER, D. M. SCHMID, G. GAUL AND D. HAURI

Botulinum A Toxin and Detrusor Sphincter Dyssynergia: A Double-Blind Lidocaine-Controlled Study in 13 Patients with Spinal Cord Disease

Treatment of Detrusor Sphincter Dyssynergia by Transperineal Injection of Botulinum Toxin

Therapeutic Satisfaction and Dissatisfaction in Patients With Spinal Cord Lesions and Detrusor Sphincter Dyssynergia Who Received Detrusor Botulinum Toxin A Injection

Transperineal Injection of Botulinum Toxin A for Treatment of Detrusor Sphincter Dyssynergia: Localization With Combined Fluoroscopic and Electromyographic Guidance

Reduction in Bladder-Related Autonomic Dysreflexia after OnabotulinumtoxinA Treatment in Spinal Cord Injury.

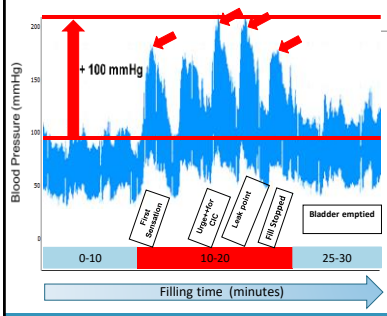
- **Study design:** prospective, open-label, pre/post comparison study with focus of effects of Botulinum toxin on Autonomic Dysrfelexia.
- **Inclusion criteria:** M & F, 18–65 years of age, traumatic SCI>1 at or above T6, confirmed AD during UDS, confirmed NDO, capable of CIC, and resistant to anticholinergic medications.
- **Total subject**
- **Data Present**
- **Outcomes:**
  - Changes ir
  - Changes ir
  - QofL outc

Original Articles

Reduction in Bladder-Related Autonomic Dysreflexia after OnabotulinumtoxinA Treatment in Spinal Cord Injury

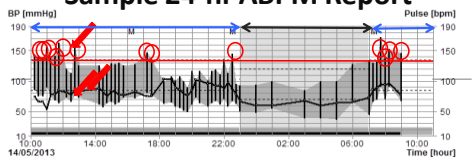
Support:
Grant from Rick Hansen Institute (Dr. Krassioukov PI)
Botox for the study was provided by Alergan Canada

AD response during UDS

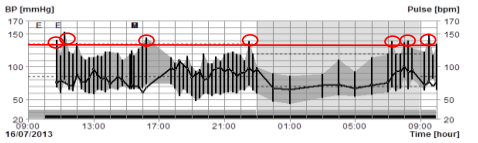


Patient profile
- 45 year old male
- C6 AIS A
- Max SBP = 202 mmHg
- Max Volume = 171 ml
- Max Pves = 45 (cm H_2O)
- **Headache,**
- **Increase in tone**
- **Sweating,**
- **Goosebumps,**
- **Flushing of the face**
- **……..**

Sample 24-hr ABPM Report

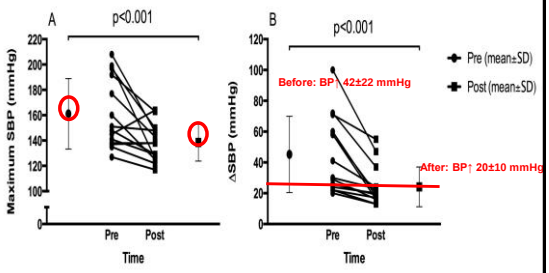


Pre-Botox max SBP = 172 mmHg, total # of AD episodes = 14



Post-Botox max SBP = 153 mmHg, total # of AD episodes = 7

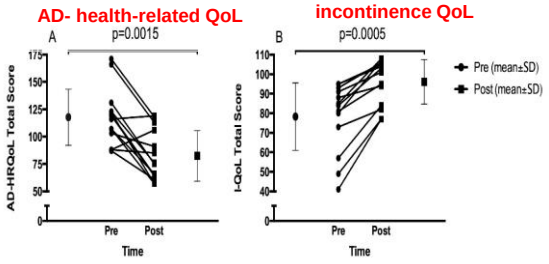
Botox reduced the severity of AD (ΔSBP) during UDS



!Botox treatments resulted in over half (57%- 10/17) of participants in ABOLISHMENT of episodes of AD during urodynamics. While the remaining 7 individuals had a 43% reduction in amplitude of AD.

Improvements in AD-related and bladder-related QoL

AD- health-related QoL | **incontinence QoL**



"Without AD, *my life* is so much better!"

"Since having the Botox treatment done, I am no longer sweating before I do my catheters. I feel like I have more control over my bladder. I can finally sleep through the night, and no longer wake up covered in sweat."

- ***Says Teri, a very happy Botox participant***

Indication: Neurogenic bladder after SCI

Questions:

Can injections of Botox for bladder issues also can help with blood pressure issues that we see in individuals with SCI?

Original Articles

Reduction in Bladder-Related Autonomic Dysreflexia after OnabotulinumtoxinA Treatment in Spinal Cord Injury

Renée J. Fougere,[1*] Katharine D. Currie,[2*] Mark K. Nigro,[1,3] Lynn Stothers,[1,2] Daniel Rapoport,[2,3] and Andrei V. Krassioukov[1,4]

episodes

of incontinent

Support:
Grant from Rick Hansen Institute (Dr. Krassioukov PI)
Botox for the study was provided by Alergan Canada

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Workshop 3: Debates and Controversies on Autonomic Dysreflexia After Spinal Cord Lesion

Tuesday 12 Sep 2017, 07:30 - 08:30 , Spadolini E

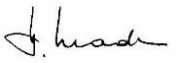
Medically Induced AD: A Useful Effect in Order To Specify The Threshold and Severity of AD Episodes and Educate Patients Or a Side Effect to Be Avoided?

Helmut Madersbacher
Innsbruck/Austria

Disclosures
Prof. Dr. H. Madersbacher

Member of the Advisory Board of
Apogepha/Germany, Astellas/Austria, Coloplast/Denmark

Lecturer for
Apogepha/Germany
Astellas/Austria
Coloplast/Denmark
Montavit/Austria



H. Madersbacher, 10.09.2017

Autonomic Dysreflexia (AD)

- In 75-90% episodes of AD triggered by events located in the lower urinary tract (LUT) and in the bowels.
- Can be iatrogenic
- Caused by:

Urological procedures	Bowel evacuation management
Urodynamics	Digital rectal evacuation
Cystoscopy	Transanal irrigation
Sperm retrieval PVS, electroejaculation	
Transurethral litholapaxie	
ESWL	

Mathias & Frankel (1983) AD is caused by an autonomic failure due to the loss of supraspinal control of spinal sympathetic centre below the level of the lesion.

Definition of blood pressure increase with AD

- ISAFSCI - *International Standards on Documentation of remaining Autonomic Function after Spinal Cord Injury*
  The primary characteristics of AD include a minumum sBP increase of 20mmHg from baseline (adults), however, in some studies also the maximum BP is reported.
- Alexander et al. 2009 Spinal Cord, Jan;47(1):36-43.
- Krassioukov et al. 2012 Spinal Cord. 2012 Jul; 35(4): 201-10.

Factors Influencing Incidence and Severness of AD

- Density of receptors stimulated

High density	Low density
Bladder neck	Bladder
Posterior urethra	Colon
Prostate	
Anal canal	

Factors Influencing Incidence and Severness of AD

- Neurologic characteristics
  - **Level**
    studies demonstrated that AD was more prevalent in cervical SCI than in thoracic SCI above Th6, also BP increased more with cervical lesions but no difference between C1-C5 and C6-C8 (Sayılır et al. 2013)
  - **C**

	Cervical lesion	Thoracic lesion above Th6
with urodynamics	37-78 %	24-77 %
with cystoscopy	80%	10-40 %

    SCI
  - **Duration since injury**
    Liu et al. (2013) severity of SCI increased with time after injury
    Linsenmeyer et al. (1996) and Giannantoni et al. (1998): no correlation of AD with the duration of injury

Factors Influencing Incidence and Severness of AD

- LUT Dysfunction and Bladder management
  - No difference in incidence of neurogenic detrusor overactivity and DSD, low compliance, uninhibited contraction, amplitude and bladder capacity between SCI individuals with or without AD Giannantoni et al. 1998, Huang et al. 2013
  - But transurethral sphincterotomy decreased frequency and magnitude of AD Barton 1986, Ricottone 1995
  - Can an increased pressure in the dilated posterior urethra induce „malignant" AD?
- Bowel management

Urodynamics as a screeing tool for AD?

Curt, Schurch et al., J Neurol Neurosurg Psychiatry. 1997 May; 62(5): 473–477.

- Urodynamics, an effective and standardized diagnostic procedure to provoke AD
- 62% of patients who showed signs of AD during urodynamics present with clinical symptoms
- 38% had **silent** AD diagnosed at the basis of systolic bladder pressure (sBP) increase
- Cardiovascular monitoring mandatory to detect AD using urodynamics as a screening tool

Table 2 Changes in systolic (SBP) and dystolic (DBP) blood pressures and heart rate (HR) in patients with signs of autonomic dysreflexia during urodynamic examination

Cardiovascular values	Basic mean (SD)	Dysreflexia mean (SD)	Difference (%)	Absolute difference
SBP (mm Hg)	115 (17)	155 (32)	35·5	40 (25)
DBP (mm Hg)	64 (13)	82 (16)	31·2	17 (16)
HR (bpm)	59 (6)	53 (10)	−14·3	8 (6)

P < 0·01.

Signs of AD induced by bladder distention and related to hyperrelfexive bladder contractions and DSD

Urodynamics as a screeing tool for AD?

Curt, Schurch et al., J Neurol Neurosurg Psychiatry. 1997 May; 62(5): 473–477.

The urodynamic examination, as a standardized diagnostic procedure, was more sensitive in indicating signs of AD, whereas sympathetic skin response (SSR) allowed the assessment of the degrees of disconnection of the sympathetic spinal centers from supraspinal control.

The combination of urodynamic examination and ambulatory BP monitoring (ABPM) is best to predict the occurrence and severity of autonomic failure.

Linsenmeyer et al., J Urol. 1996 Feb;155(2):519-22.

Found urodynamics as an excellent tool in detecting both symptomatic and silent AD in men with SCI above Th6 who were at an increased risk for AD.

AD Severness Cystoscopy vs. Urodynamics

Liu et al. Spinal Cord. 2013 Nov;51(11):863-7.

During cystoscopy SCI individuals developed greater changes in sBP than urodynamics (67.1 ± 33.8 vs. 51.8±21.8 mmHg) indicating that stimulation of the urethra/prostate/internal sphincter region probably is a more potent stimulus of AD than just the filling of the bladder.

Rivas et al. (1994) proposed that with reduced caliber of the flexible cystoscope would markedly decrease the incidence and severity of AD during examination when compared to the use of rigid endoscopes.

Recommendations for Daily Practice Prevention of AD

- Patient information about AD, its symptoms and trigger mechanisms is important.
- Use a flexible cystoscope
- Pharmacologic prevention possible - Nifedipine 10mg orally 30 minutes before procedure, also Botulinumtoxin A effective
- Any type of anaesthesia (general, spinal, topic) may prevent/minimize AD by blocking the afferent input
- With topic anaesthesia controversial results

  Does lidocain gel instilled into the urethra reach the posterior urethra/bladder neck area?

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Workshop 3: Debates and Controversies on Autonomic Dysreflexia After Spinal Cord Lesion

Tuesday 12 Sep 2017, 07:30 - 08:30 , Spadolini E

Medically Induced AD:

A Useful Effect in Order To Specify The Threshold and Severity of AD Episodes and Educate Patients: YES, but cardiovascular monitoring mandatory

Or a Side Effect to Be Avoided?
YES, if AD is already known

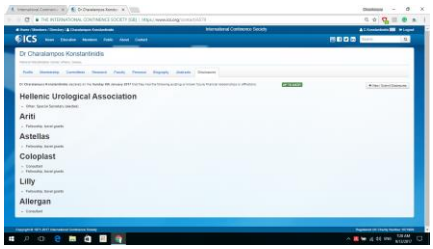
WORKSHOP 3

DEBATES AND CONTROVERSIES ON AUTONOMIC DYSREFLEXIA AFTER SPINAL CORD LESION

SEXUAL ACTIVITY & AD: SEXUAL ACTIVITY, A FACTOR INDUCING AD EPISODES

Charalampos Konstantinidis, MD, FEBU, FECSM
Consultant in Urology & Sexual Medicine
National Rehabilitation Center, Athens, Greece

Disclosures

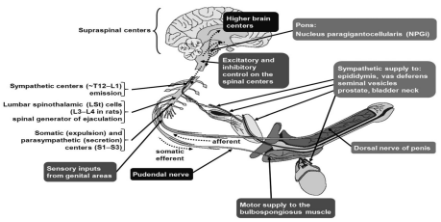


Initiative factors of AD

- Exaggerate sympathetic response triggered by either noxious or non-noxious stimuli below the level of the SCI
  - Urological procedures, TUR instrumentation
  - Bladder distention, bowel impaction/distention
  - Pressure ulcers, Toenails into the skin or other wounds
  - Sexual activity and stimulation of the genitalia
  - **Ejaculation not only provokes AD but may drives to malignant AD**

Davidson R, Elliott S, Krassioukov A. Cardiovascular Responses to Sexual Activity in Able-Bodied Individuals and Those Living with Spinal Cord Injury. J Neurotrauma. 2016 Dec 15;33(24):2161-2174
Courtois F, Charvier K, Leriche A,et al. Perceived physiological and orgasmic sensations at ejaculation in spinal cord injured men. J Sex Med. 2008 Oct;5(10):2419-30.
Courtois F, Geoffrion R, Landry E, et al. H-Reflex and Physiologic Measures of Ejaculation in Men With Spinal Cord Injury. Arch Phys Med Rehabil 2004; 85: 910–918.

Neurophysiology of ejaculation



Giuliano F. Neurophysiology of erection and ejaculation. J Sex Med 2011;8:310–315.

Neurophysiology of ejaculation

Table 16a.1 The three stages of normal ejaculation

Emission	Triggered by activation of the sympathetic spinal cord centre (T10–L2) upon increasing sexual stimuli
	Peristaltic contraction of epididymis and vas deferens with progressive transport of sperm.
	Contraction of seminal vesicles and prostate with excretion of seminal fluid and emptying of the seminal fluid into the posterior urethra.
	Ejaculatory sensation resulting from distension of posterior urethra and increasing pressure.
Ejection	Triggered by the parasympathetic and somatic (pudendal nerve) spinal reflex center (S2–S4).
	Rhythmic contractions of bulbocavernous/pelvic floor muscles with synchronisation of bladder neck closure and relaxation of external urinary sphincter.
Orgasm	Processing of sensory and somato-motoric sensations/feelings originating from the internal genitals, urethra and pelvic floor muscle contractions.

Porst H, Cruz N. Basic anatomy and physiology of ejaculation, classification of ejaculatory desorders. In: Porst H, Reisman Y. The ESSM Syllabus of Sexual Medicine. Medix ed. 2012. p 669

Malignant AD

- Severe AD develops with a tendency of progressive worsening even when the alleviating factor is removed.
- After ejaculation
- Severe (systolic BP>220mmHg)
- Prolonged (duration more than a week)

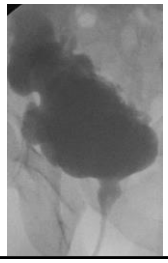
Elliott S, Krassioukov A. Malignant autonomic dysreflexia in spinal cord injured men. Spinal Cord. 2006 Jun;44(6):386-92

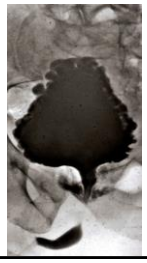
Prolonged duration

- Malignant AD characterized by the continuation of the syndrome even when the alleviating factor is removed
- After ejaculation what is the remaining "triggering" factor which is responsible for the syndrome?
- What conditions develop in the prostatic urethra during or after ejaculation?

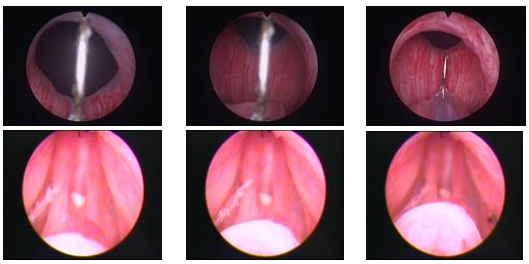
Detrusor – Sphincter Dyssynergia (DSD)

- Distention of prostatic urethra due to high pressure
- Intraprostatic reflux



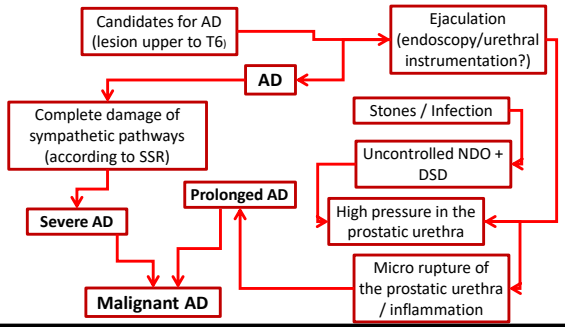


DSD - Distention of prostatic urethra



Proposed mechanisms of Malignant AD

- After the removal of stimulation, AD is self controlled
- Inflammation and/or micro raptures of the urothelium of the prostatic urethra after ejaculation, due to high pressure, may act as a continue stimulus resulting in malignant AD

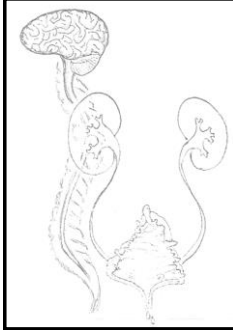


Candidates for malignant AD

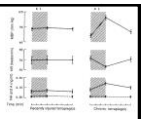
- SCI patients with complete rapture of sympathetic pathways
- After ejaculation
- Severe and uncontrolled NDO + DSD
- After endoscopy?
- Bladder stones
- Infection
- Low compliance?

Take home messages

- Awareness of malignant AD among patients and health care professionals, during sperm retrieval, is very important for the prompt recognition and treatment
- In AD candidates, it is important to be concerned with the phenomenon and to start their "new" sexual experience step by step until they can estimate the cutoff point of the initiation of AD, in order to stop on time, before the dysreflexia become more severe



Thank you for your attention



Sexual Health & AD:
AD- a Syndrome Mimicking Orgasm?

Pr Pierre Denys
Hôpital Raymond Poincaré APHP
University of Versailles
France

Pierre Denys

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Affiliations to disclose†:

Allergan / speaker investigator
Ipsen / investigator
Wellspect coloplast Astellas / adboard

† All financial ties (over the last year) that you may have with any business organisation with respect to the subjects mentioned during your presentation

Funding for speaker to attend:

- ☐ Self-funded
- ☐ Institution (non-industry) funded
- ☒ Sponsored by: *Allergan*

Definition of orgasm

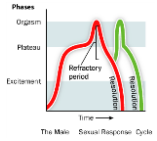
♂ Perceptual experience of the internal reproductive organ contractions, distension of the urethra as a result of emission and stimulation of the pressure corpuscles in the glans penis

♀ a peak of intense pleasure accompanied with an altered state of consciousness, feeling of well-being and contentment, rhythmic contractions of the perineal muscles and myotonia

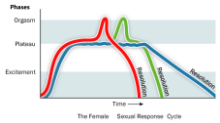
McMahon CG, Abdo C, Incrocci L et al. Disorders of orgasm and ejaculation in men. In Lue T, Basson R, Rosen R et al. eds. Sexual Medicine: Sexual Dysfunctions in Men and Women. 2nd International Consultation on Sexual Dysfunctions, Paris: Editions 21, 2004: 409–68
Meston CM, Hull E, Levin RJ, Sipski M. Women's orgasm. In Lue T, Basson R, Rosen R et al. eds. Sexual Medicine: Sexual Dysfunctions in Men and Women. 2nd International Consultation on Sexual Dysfunctions, Paris: Editions 21, 2004: 783–850

Sex isn't the best thing in the world , or the worst thing in the world. But there is nothing else quite like it. WC Fields

The EPOR Model

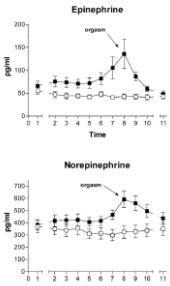


Studies on peripheral autonomic and somatic response during sexual activity of more than 10000 subjects



A rise in BP and HR in the general population

- Non genital phenomena well describe by Masters and Jonhson
- A moderate rise in blood pressure during sexual activity and orgasm M>F
- More clearly describes because of the debate of cardiac risk of IPDE 5



Palmeri ST, Heart rate and blood pressure response in adult men and women during exercise and sexual actiivty Am J Cardiol 2007; 100,1795-1801

Review

Cardiovascular Responses to Sexual Activity in Able-Bodied Individuals and Those Living with Spinal Cord Injury

- During PVS and electroejaculation
  - A higher rise in SBP in case of cervical and high thoracic compared to low thoracic or lumbar level
  - Intensity depends on method of BP recording (intermittent vs continuous)
  - Associated to ejaculation rather than sexual stimulation

TABLE 3 Variations in SBP/DBP and heart rate at ejaculation compared with during sexual stimulation alone

	Ejaculation	Sexual stimulation alone	P
SBP	153 mmHg	118 mmHg	$P < 0.001$
DBP	85 mmHg	69 mmHg	$P < 0.001$
Heart rate	63 beats per min	72 beats per min	$P < 0.001$

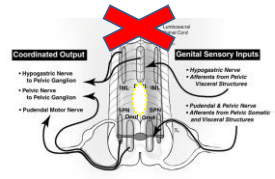
Sexual activity and AD : the female SCI patient

- Less clear difference from the litterature between able bodied and SCI on HR and SBP during orgasm and sexual stimulation
- But no results on vibratory stimulation

Sexual Arousal and Orgasm in Women: Effects of Spinal Cord Injury

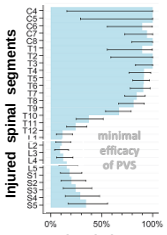
Marca L. Sipski, MD,[1,2] Craig J. Alexander, PhD,[1,2] and Raymond Rosen, PhD[3]

The role of spinal generator of ejaculation in AD



penile vibratory stimulation

Sonksen et al., Paraplegia, 1994; Brackett N et al., J Urol, 1998



Chehensse et al., Hum Reprod Update, 2013

Is it stimulation dependant or ejaculation dependant

- In favor of ejaculation driven
- The role of CPG driving AD still needed to be demonstrated

TABLE 3 Variations in SBP/DBP and heart rate at ejaculation compared with during sexual stimulation alone

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F Courtois. Assessing and conceptualizing orgasm after a spinal cord injury BJUI 2011 108 1624-1633

AD- a Syndrome Mimicking Orgasm?

- No evidence from the littérature that AD alone can mimick orgasm
- But in presence of AD during ejaculation the patient report more frequently orgasmic sensation

F Courtois. Assessing and conceptualizing orgasm after a spinal cord injury BJUI 2011 108 1624-1633

Still a lot of questions

- Clear definition of orgasm is still mandatory
- Is AD out of any sexual stimulation mimick orgasm ????
- The role of CPG in driving AD rather than the peripheral stimulation is questionnable
- Differences in male and female ?