ICS Teaching Module: Electromyography in the assessment and therapy of lower urinary tract dysfunction in adults

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Electromyography in the assessment and therapy of lower urinary tract dysfunction in adults

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Principle of EMG

- Recording of the electrical activity from (striated) muscle with electrodes, to unveil function and innervation.

2 methods:

Needle EMG > Needle electrode(s): Inside muscle – motor unit

- Positive: - allows assessment of single action potentials
- Negative: - invasive - complex expertise in EMG required

Surface EMG > Surface (patch) electrode(s): On muscle – 'whole' muscle

- Positive: - non-invasive, less time- and money-consuming
- Negative: - less specific, less 'detail' - does not allow assessment of single action potentials

EMG tests in adult urology

- Needle EMG of external anal sphincter (EAS)
- Needle EMG of external urethral sphincter (EUS)
  - Monopolar
  - Bipolar (concentric)
  - Wire(s)
- Surface EMG of external anal sphincter (EAS)
- Surface EMG and sacral reflexes conductivity testing
- Surface EMG and biofeedback
- Surface EMG with cystometry and pressure/flow
- Surface EMG = ‘kinesiological EMG’: with pair (or array) of electrodes over muscle

Needle EMG of external anal sphincter (EAS)

Principle:

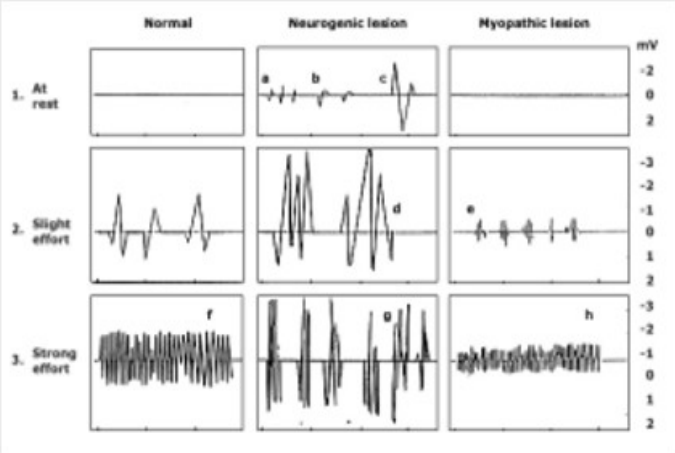
- Recording of electrical activity of EAS
- Elements of muscle activity of the pelvic floor

Technique:

- Patient in lateral decubitus or lithotomy position
- EAS: Needle electrodes inserted bilaterally, approximately 0.5 cm lateral to the anus
- Assessment during maximal relaxation, during slight pelvic floor contraction, during maximal voluntary contraction and or during artificial bladder filling

Needle EMG of external anal sphincter (EAS)

- Evidence:
- Potentially useful to detect disturbances in neuroregulation of the pelvic floor muscles in patients with
  - lower motor neuron lesion
  - demyelinating diseases
  - with Parkinson disease
  - Multiple System Atrophy



Sakakibara R, et al.: J Neurol Neurosurg Psychiatry 2000; 68:25

Needle EMG of external urethral sphincter (EUS)

Principle:

- Direct recording of electrical activity of EUS

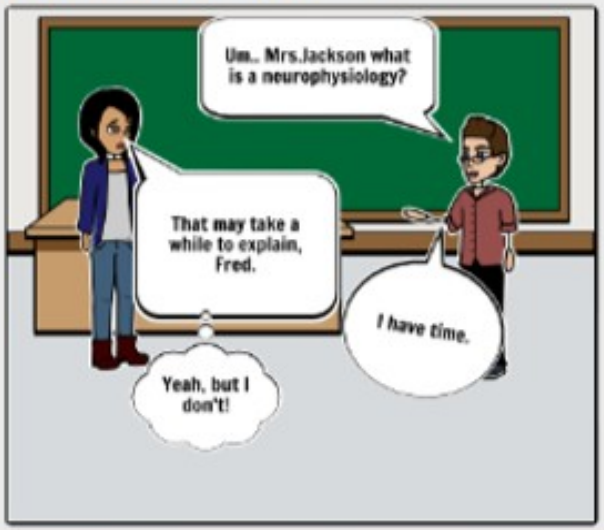
Technique:

- Patient in lateral decubitus or lithotomy position
- Needle electrodes inserted transperineally (♂) or transvaginally (♀) or transurethrally – via catheter
- Assessment during maximal relaxation, during slight pelvic floor contraction, during maximal voluntary contraction and or during artificial bladder filling

Needle EMG of external urethral sphincter (EUS)

Evidence:

- Limited evidence for role in clinical setting for EUS –EMG
- Some role in Fowler's (retention) syndrome
- Potentially useful in direct detection of electrical activity while bladder filling



Surface EMG of external anal sphincter (EAS)

Principle:

- Recording of muscle activity using surface (patch) electrodes or electrodes on cone or plug

Technique:

- Degreasing of the perianal skin
- 2 'active' electrodes adjusted bilaterally to the muco - cutaneus line + ground electrode
- Assessment of activity rest vs. contraction

Evidence:

- Tool to detect pelvic floor muscle activity or relaxation

Surface EMG and Sacral reflexes conductivity testing

Principle:

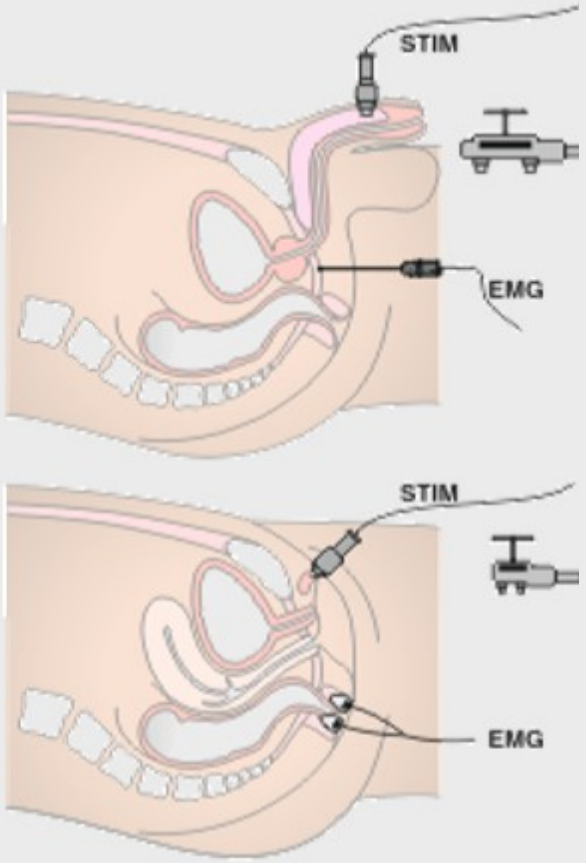
- Stimulation of the pudendal nerve to induce pelvic floor contraction to evaluate of bulbocavernosus (cliteroanal) reflex

Technique:

- Stimulation using electrode dorsal at the base on the penis (♂) or on clitoris (⚲)
- The response recorded with surface or needle electrodes from the region of anal sphincter or bulbocavernous muscle

Evidence:

- Absence or delay in response, suggest lower motor neuron impairment
- No relevant recent study which could support the role of this examination in the daily clinical work-up was found



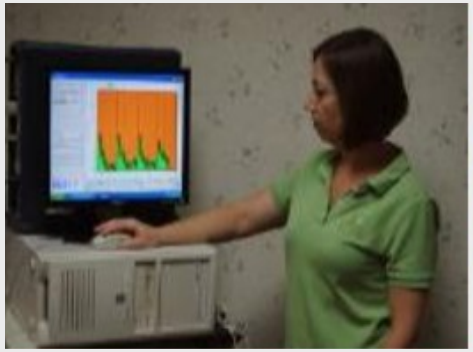
Surface EMG and biofeedback

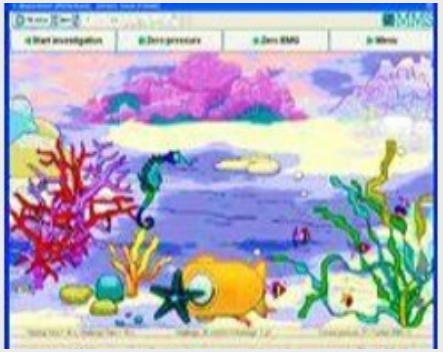
Principle:

- Detect the pelvic floor muscle activity and transform it into a visual and/or acoustic display in order convey the information to the patient

Technique:

- Surface electrodes are placed close to the anal sphincter or on an anal or intravaginal plug
- Recorded signal transformed into apparent sound or visual clue
- Allows the patient to better understand the functional status of the pelvic floor





Surface EMG and biofeedback

Clinical observations:

- Baseline between contractions – inconsistent and elevating
- Resting baseline – varies widely from session to session, especially when pain exists
- Erratic tracing without artifact or noise
- Patient has symptoms of overactive PFM – obstructed urination, defecation, pain
- Return to baseline after startle or frightening – overactive PFM is slow
- 2/3 of dysfunctional muscles will have normal resting baseline

Surface EMG and biofeedback

Evidence:

- Potentially useful for conservative treatment (PFM training) of stress urinary incontinence and OAB
- Little evidence regarding the use of EMG biofeedback as tool to help relax the pelvic floor muscles during micturition in adults

Surface EMG with cystometry

Principle:

- Recording of pelvic floor muscle activity during filling of the bladder.

Technique:

- Surface EMG (as on earlier slides)

Evidence:

- Introduced on the basis of expert opinion/ plausibility
- No (comparative) evidence
- Surface EMG may fail to reflect urethral (continence) function

Surface EMG with pressure flow studies

Principle and technique:

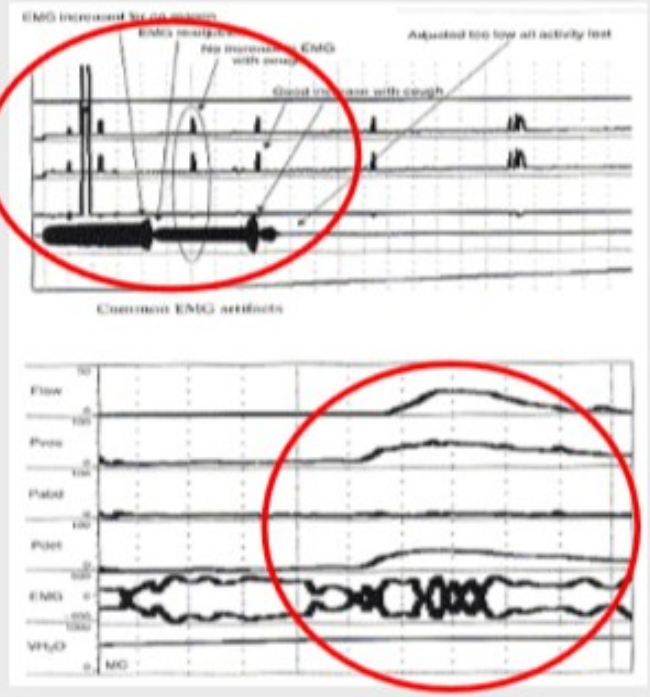
- Identical to surface EMG

Evidence:

- Introduced on the basis of expert opinion/ plausibility
- No (comparative) evidence
- Expert series demonstrating plausible results
- However: Large (n= 655) prospective cohort with EMG revised:
  - Many (51%) were not interpretable (but also)…
  - …surface EMG failed to reflect EUS relaxation.

Surface EMG (adult)

- May be not interpretable - (technical) artefacts
- May give not plausible results - Not reflect relevant (EUS) activity - Smooth flow-rate and bizarre EMG



sEMG with urodynamic tests (adult)

Lacking practice standards for:

- Display: envelope; linear envelope; full wave; half wave
- Time scale
- Sampling: … Hz; Filtering: moving average; root mean square
- Placing of active electrodes (♀; ♂)
- Impedance check(s) (cleaning of skin): <5 (or <10) kΩ
- Reference electrode - neutral! (Not on another muscle); trochanter; pelvic rim; sacrum
- Technical and clinical quality checks
- Analysis, interpretation and reporting

sEMG with urodynamic tests (adult)

- Not very invasive
- Not very time and cost consuming

- Without standard
- Without certainty of relevance

- May add confusion if artefacts are not acknowledged

- May be of help in (pelvic) muscle strength and control training and learning to relax

EMG tests in adult urology

- The concept of use of EMG methods in functional urology/urogynaecology and physiotherapy is supported by good theoretical basis
- Current value of EMG in diagnosis is however limited
- Currently EMG practice can only rarely play a decision making role in diagnostics of LUT partially due to lack of standards