Mapping of brain activity following transcutaneous poster tibial nerve stimulation for lower urinary tract symptoms in pediatric patients: A PET study

Dr MS Ansari, Dr Priyank Yadav

Div. Of Pediatric urology, Sanjay Gandhi postgraduate institute of Medical Sciences

Lucknow- India (ansarimasa@hotmail.com)

Introduction

- Peripheral nerve stimulation via lumbosacral route has shown to modulate cortical and subcortical brain areas which seem to control the complex process of micturition, i.e. sensation of bladder filling and the timing of micturition (1)
- The present study was conducted to investigate the **changes in brain activity during modulation of various brain areas** after transcutaneous posterior tibial nerve stimulation (TcPTNS) for lower urinary tract symptoms (LUTS) in pediatric patients

Methods

- 18 FDG PET was used to investigate the effects of PTNS on brain activity in pediatric patients with urodynamically proven detrusor overactivity (DO) or underactive detrusor (UD)
- All the patient underwent weekly session for 30 minutes for 12 weeks (Induction therapy) followed by 3 weekly maintenance therapy
- PET CT brain was done before the start of TcPTNS and at the end of induction therapy i.e. 3 months

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Results

- Number of patients: 31
- Median age: 5.6Yrs
  (range 4-16 yrs)
- Type of bladder dysfunction
  - Detrusor activity: 20
  - Underactive detrusor: 11

- 18 FDG PET changes in **detrusor activity (DO)**

Decreased activity reported in

- Mid-cingulate gyrus (Fig 1a)
- Hypothalamus (Fig 1b)
- Frontal cortex [more on right side] (Fig 1c)
- Lateral pons (Fig 1d)

- PET changes in **underactivity**

Avid activity noted in

- Lateral cingulate gyrus (Fig 2a)
- Mid pons
- Periaqueductal grey [PEG]

Evaluation of clinical outcome: As per The International Childrens'Continence Society (ICCS) definitions (2006)

Mid-cingulate gyrus

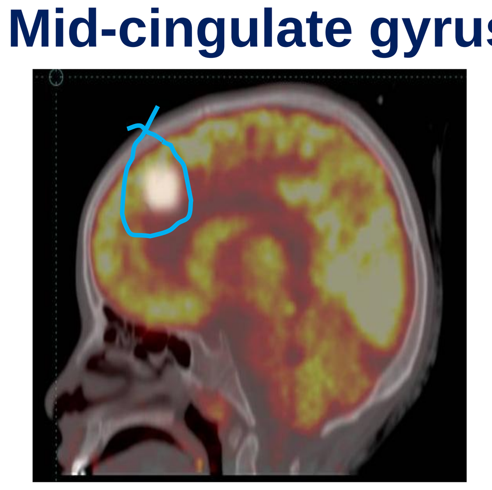

Fig. 1a

Hypothalamus

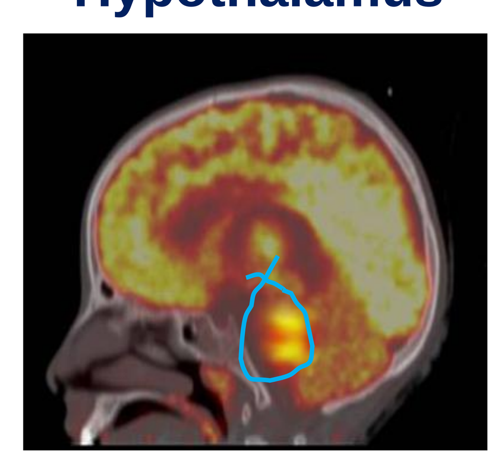

Fig. 1b

Premotor cortex

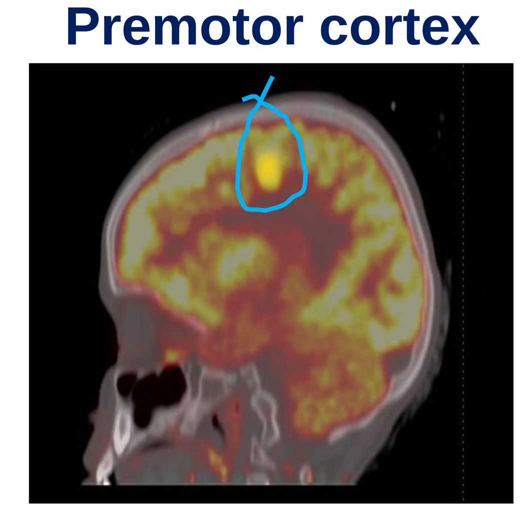

Fig. 1c

Lateral pons

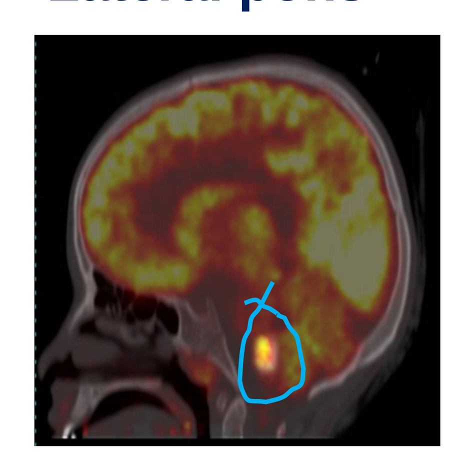

Fig. 1d

Lateral cingulate gyrus

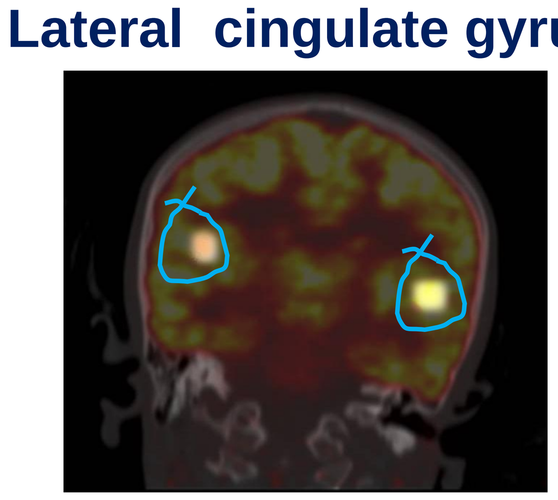

Fig. 2a

Discussion

- The process of storage of urine and voiding is extremely complex involving the integrated response of higher brain centres such as frontal cortex,perieqidectal gray matter (PAG), cingular gyrus, hypothalamus, pons and sacral spinal cord (1-2).
- Both on PETCT and functional (fMRI) increased activity has been reported in certain specified regions in the brain (2-3)
- Likewise decreased activity has been revealed during the storage of urine in other regions of the brain (2-3)

CONCLUSIONS

The focus of brain activation changes according to the sense of bladder filling or voiding

To overcome urge
[in cases of DO]

To initiate voiding
[in cases of underactive detrusor]

References

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