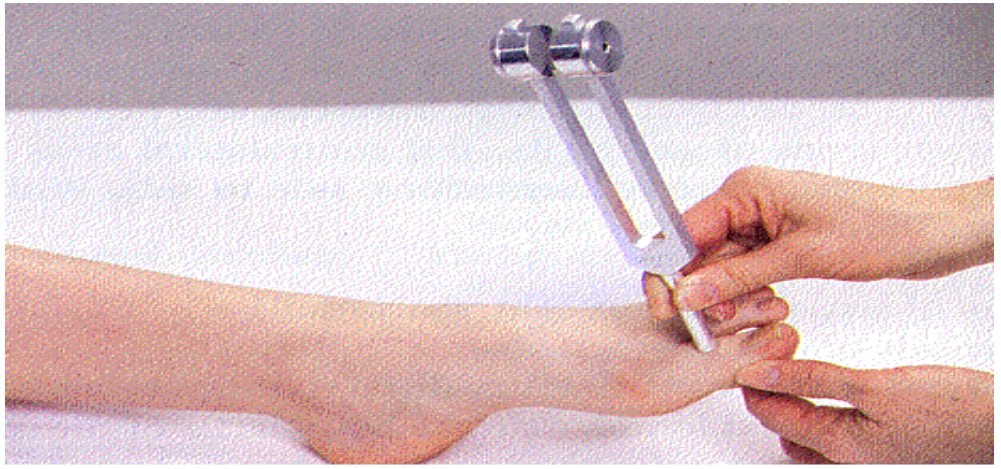
Neurology Examination

Dr. Bandar Al Jafen, MD
Head of Neurology
Assistant Professor
Consultant Neurologist and Epileptologist
King Saud University, Riyadh



Objectives

- Understand neurological examination
- Perform a neurological examination
- Higher function
- Cranial nerves
- Motor system
- Sensory system
- Interpret neurological examination

Examination of higher mental functions and sensory examination

Examination of higher mental functions

Mental Status

- **Handedness**
- **Alertness**
- **Attention**
- **Orientation**
  - Person, Place, Time
- **Cognitive function**
- **Perception**
  - Illusions = misinterpretations of real external stimuli
  - Hallucinations = subjective sensory perceptions in the absence of stimuli
- **Judgment**
- **Memory**
  - Short-term & long-term
- **Speech**
  - Rate & rhythm
  - Spontaneity
  - Fluency
  - Simple vs. complex

Testing Cognitive Function

- **Information & vocabulary**
  - Common
- **Calculating**
  - Simple math
  - Word problems
- **Abstract thinking**
  - Proverbs
  - Similarities/differences
- **Construction**
  - Copy figures of increasing difficulty (i.e. circle, clock)

Bedside memory testing is limited!

Testing requires alertness and is not possible in a confused or dysphasic patient!

- **Short-term memory** – DIGIT SPAN TEST – ask the patient to repeat a sequence of 5, 6, or 7 random numbers.

- **Long-term memory** – ask the patient to describe present illness, duration of hospital stay or recent events in the news (RECENT MEMORY), ask about events and circumstances occuring more than five years previously (REMOTE MEMORY).

- **Verbal memory** – ask the patient to remember a sentence or a short story and test after 15 minutes.

- **Visual memory** – ask the patient to remember objects on a tray and test after 15 minutes

Memory

Explicite memory (declarative)

long-term m. (> 1 min)

episodic m.

(autobiographic data)

(mesiotemporal regions – **hipp**,entorh, perirh, GP)

semantic m.

(encyclopedic knowledge)

(more extensive reg. – MT+LT,P,O)

(visual x verbal, recall x recognition)

short-term (working) m. (30-40 s) (digit span)

(DLPFC + associative visual and auditory areas)

Implicit memory

demonstrated by completion of tasks that do not require conscious processing

procedural m. (completing word fragment, m. for movements)

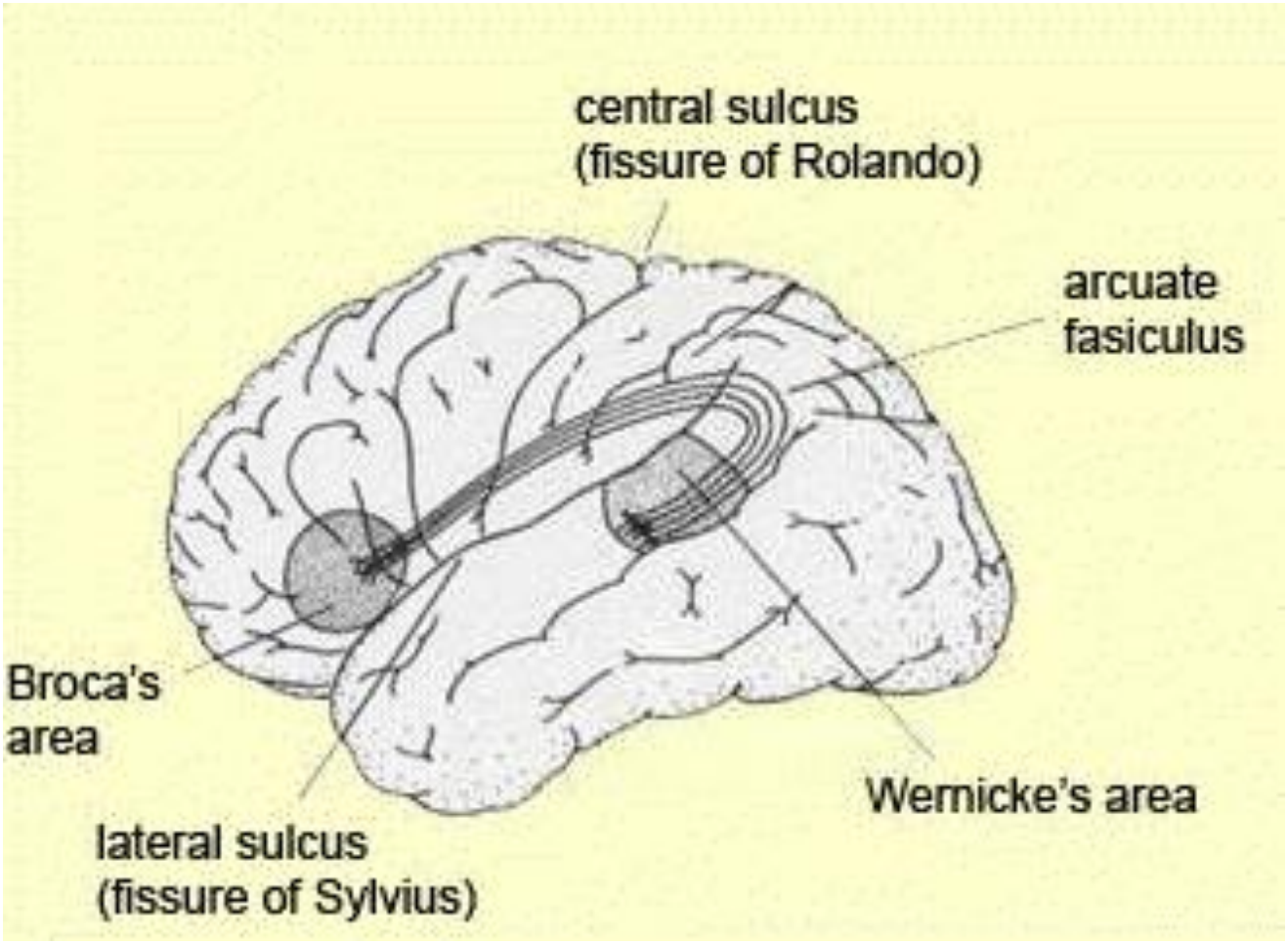
(subcortical circuits – BG, cerebellum + ctx visual, motor,..)

priming

= the ability to acquire a motor skills or cognitive routines by experience

Memory System	Examples	Awareness	Length of Storage	Major Anatomic Structures
Episodic memory	Remembering a short story, what you had for dinner last night, and what you did on your last birthday	Explicit Declarative	Minutes to years	Medial temporal lobe, anterior thalamic nucleus, mamillary body, fornix, prefrontal cortex
Semantic memory	Knowing who was the first US president, the color of a lion, and how a fork and comb are different	Explicit Declarative	Minutes to years	Inferior lateral temporal lobes
Procedural memory	Driving a standard transmission car and learning the sequence of numbers on a touch-tone phone without trying	Implicit Nondeclarative	Minutes to years	Basal ganglia, cerebellum, supplementary motor area
Working memory	Phonologic: keeping a phone number "in your head" before dialing Spatial: Mentally following a route, or rotating an object in your mind	Explicit Declarative	Seconds to minutes; information actively rehearsed or manipulated	Phonologic: prefrontal cortex, Broca area, Wernike area Spatial: prefrontal cortex, visual association areas

Speech and Language



SPEECH

1. Aphasia

Broca's aphasia = expressive aphasia = motor aphasia
Wernicke's aphasia = receptive aphasia = sensory aphasia
Nominal aphasia = anomic aphasia

The following patterns of aphasia can be recognized associated with lesions at the sites are numbered:

1. **Wernicke's aphasia** – poor comprehension, fluent but often meaningless speech. No repetition.
2. **Broca's aphasia** – preserved comprehension, non- fluent speech. No repetition.
3. **Conductive aphasia** – loss of repetition with preserved comprehension and output.
4. **Transcortical sensory aphasia** – as in (1) but with preserved repetition.
5. **Transcortical motor aphasia** – as in (2) but with preserved repetition.

2. Dysphonia

This is a disturbance of voice production and may reflect either local vocal cord pathology, an abnormality of the nerve supply via the vagus or occasionally a psychological disturbance.

3. Dysarthria

Dysarthria can therefore reflect difficulties at different levels.

Lesions of upper motor neurone type, of the extrapyramidal system such as Parkinson's disease) and cerebellar lesions disturb the integration of processes of speech production and tend to disturb the rhythm of speech.

Lesions of one or several of the cranial nerves tend to produce characteristic distortion of certain parts of speech.

APHASIA

WHAT TO DO

Establish if right-or left-handed.

Discover his first language.

Assess understanding

Ask the patient a simple question

- What is your name and address?
- What is your job? Explain exactly what you do
- Where do you come from?

Test his understanding

- Ask questions with **yes/no answers.**

e.g. 'Is this a pen?' (showing something else, then a pen)

- Give a **simple command.**

e.g. 'Open you mouth' or 'With your right hand touch your nose‘

If successful:

- Try more complicated commands.

Assess spontaneous speech

Ask further questions

Assess word finding ability and naming

- Ask him to name all the animals he can think of (normal 18-22 in 1 minute).
- Ask him to give all the words beginning with a particular letter.
- Ask him to name familiar objects.

Assess repetition

- Ask the patient repeat a simple phrase, then increasingly complicated phrases.

<u>FURTHER TESTS</u>

Test reading and writing

Ask the patient to:

- read a sentence
- obey written command

Impaired reading = *dyslexia*, impaired writing = *dysgraphia.*

WHAT IT MEANS

- **Aphasia:** lesion in the dominant (usually left) hemisphere.
- **Global aphasia:** lesion in dominant hemisphere affecting both Wernicke's and Broca's areas
- **Wernicke's aphasia:** lesion in Wernicke's area (supramarginal gyrus of the parietal lobe and upper part of temporal lobe). May be associated with field defect.
- **Broca's aphasia":** lesion in Broca's area (inferior frontal gyrus). May be associated with a hemiplegia.
- **Conductive aphasia:** lesion in arcuate fasciculus.
- **Transcortical sensory aphasia:** lesion in posterior parieto-occipital region.
- **Transcortical motor aphasia:** incomplete lesion in Broca's area.
- **Nominal aphasia:** lesion in angular gyrus.

Cognitive skills

Listen to language pattern	- hesitant	**Expressive dysphasia**
	- fluent	**Receptive dysphasia**
Ask the patient to name objects		**Nominal dysphasia**
Does the patient read correctly?		**Dyslexia**
Does the patient write correctly?		**Dysgraphia**
Ask the patient to perform a numerical calculation, e.g. serial 7 test, where 7 is subtracted serially from 100.		**Dyscalculia**
Can the patient recognise objects? e.g. ask patient to select an object from a group.		**Agnosia**

Cognitive skills

Non-dominant hemisphere disorders

Note patient's ability to find his way around the word or his home.	**Geographical agnosia**
Can the patient dress himself?	**Dressing apraxia**
Note patient's ability to copy a geometrical pattern, e.g. ask patient to form a star with matches or copy a drawing of a cube.	**Constructional apraxia**

Types of Agnosia

- Visual agnosias – inability to recognise familiar objects e.g.
  - **Prosopagnosia** – inability to recognise faces
  - **Agnostic alexia** – inability to read
  - **Colour agnosia** – inability to retrieve colour information e.g. what colour are bananas
  - **Object agnosia** – inability to name objects
  - **Simultiagnosia** – inability to recognise a whole image although individual details are recognised

Apraxia

-**Apraxia* or Dyspraxia:** a deficit or impairment in performing skilled voluntary movements; when this occurs in children is falls under the category of "developmental dyspraxia")

-**Ideomotor Apraxia or Dyspraxia** : a problem in the execution or imitation of simple gestures (e.g., wave goodbye, salute, using hammer). The problem occurs in converting a command to a behavior. Etiology is left hemisphere and often involves language areas as well (note: limited gesturing is present in children in the Autism Spectrum).

Mini-mental state examination

Orientation

1. What is the year, season, date, month, day? (one point for each correct answer)
2. Where are we? Country, county, town, hospital, floor? (one point for each answer)

Registration

3. Name three objects, taking 1 second to say each. Then ask the patient to name all three. One point for each correct answer. Repeat the question until the patient learns all three

Attention and calculation

4. Serial sevens. One point for each correct answer. Stop after five answers
   Alternative: spell "WORLD" backward

Recall

5. Ask for names of the three objects asked in question 3. One point for each correct answer

Language

6. Point to a pencil and a watch. Ask the patient to name them for you. One point for each correct answer
7. Ask the patient to repeat "No ifs, ands, or buts". One point
8. Ask the patient to follow a three-stage command: "Take the paper in your right hand; fold the paper in half; put the paper on the floor." Three points
9. Ask the patient to read and obey the following: CLOSE YOUR EYES (Write this in large letters.) One point
10. Ask the patient to write a sentence of his or her own choice. (The sentence must contain a subject and an object and make some sense.) Ignore spelling errors when scoring. One point
11. Ask the patient to copy two intersecting pentagons with equal sides. Give one point if all the sides and angles are preserved and if the intersecting sides form a quadrangle

Maximum score = 30 points; score > 24 normal; < 24 suggests dementia

Parietal Lobe

Dysphasia (dominant)
Acalculia,* agraphia,* left-right disorientation,* finger agnosia*
Sensory and visual inattention,† construction and dressing apraxia,† spatial neglect and inattention,† lower quadrantic hemianopia,‡ astereognosis‡
Seizures

Temporal Lobe

Memory loss
Upper quadrantic hemianopia
Dysphasia (receptive if dominant lobe)
Seizures

Frontal Lobe

Personality change
Primitive reflexes, e.g., grasp, pout
Anosmia
Optic nerve compression (optic atrophy)
Gait apraxia
Leg weakness (parasagittal)
Loss of micturition control
Dysphasia (expressive)
Seizures

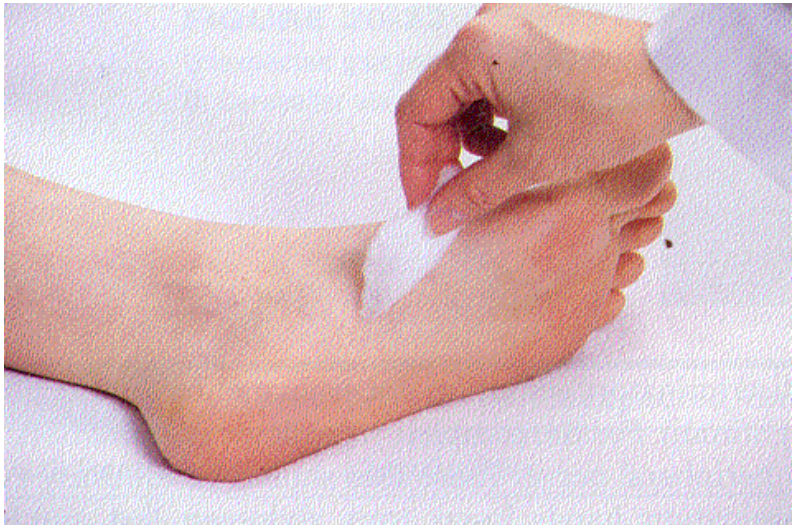
Occipital Lobe

Homonymous hemianopia
Alexia
Seizures (flashing light aura)

Summary of HMF examination

- **Alertness**
- **Attention**
- **Orientation**
  - Person, Place, Time
- **Cognitive function**
- **Perception**
- **Judgment**
- **Memory**
  - Short-term & long-term
- **Speech**
  - Rate & rhythm
  - Spontaneity
  - Fluency
  - Simple vs. complex

Sensory Examination



Spinothalamic Tract

- *Pain* and *temperature*
- *Light touch* (light touch without localization)

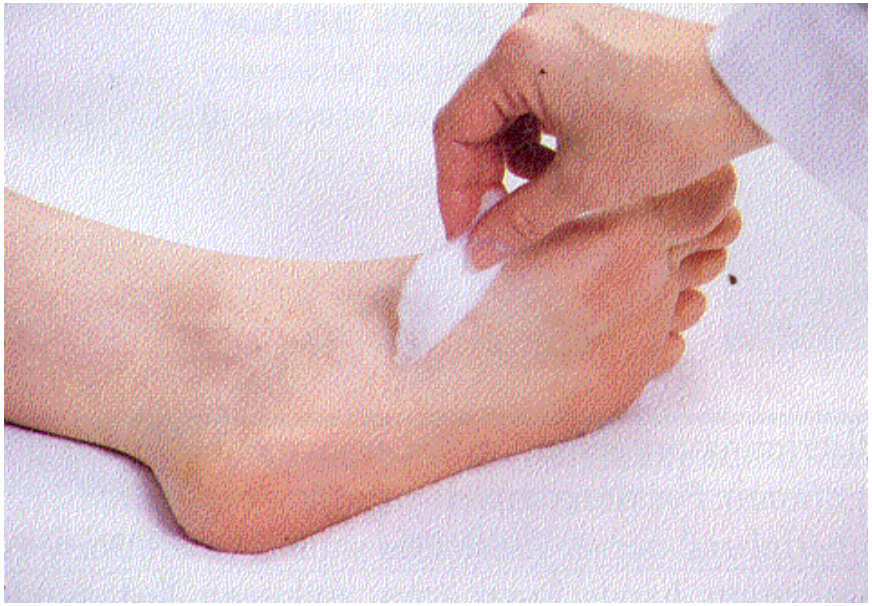
Pain Sensation

- Sharp safety pin or other tool
- Demonstrate sharp & dull
- **Test by:**
  - Alternating sharp & dull w/ pt's eyes closed
- **Ask patient:**
  - Sharp or dull?
  - Does this feel same as this?
  - Lightest pressure needed - do not draw blood

Temperature

- Often omitted if pain sensation normal
- Two test tubes
  - filled with hot & cold water
  - or tuning fork heated or cooled by water

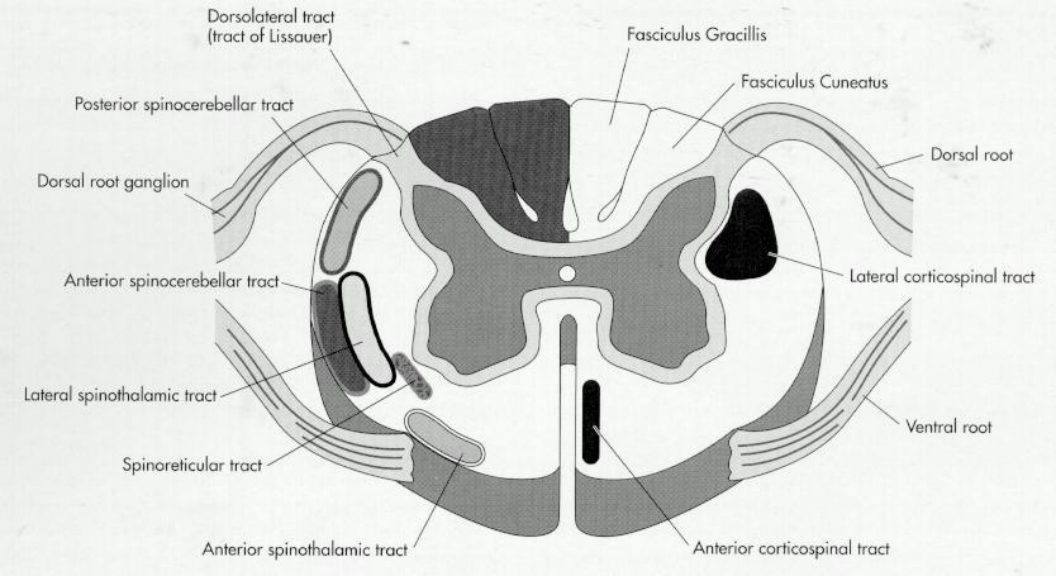
Light Touch



- Wisp of cotton
- Touch lightly - avoid pressure
- Ask patient:
  - To respond when touch is felt
  - Compare one area with another

Posterior Columns

- *Position* and *vibration*
- *Fine touch*
- Synapse in medulla, cross & continue on to thalamus

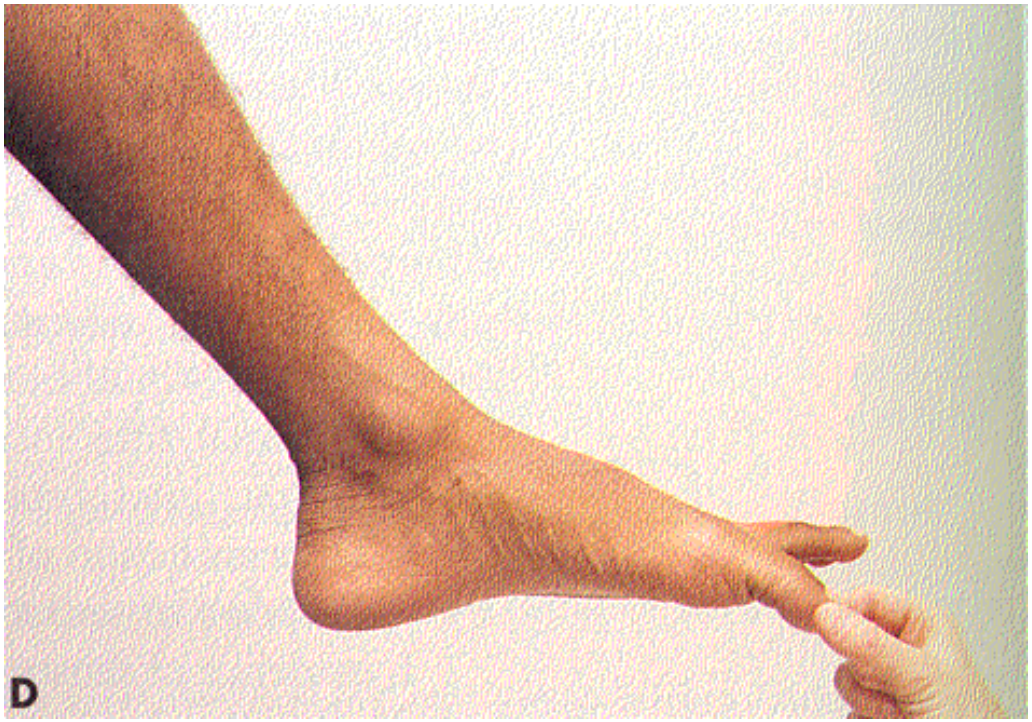


Vibratory Sense

- 128 or 256 Hz Tuning fork
- If impaired, proceed proximally

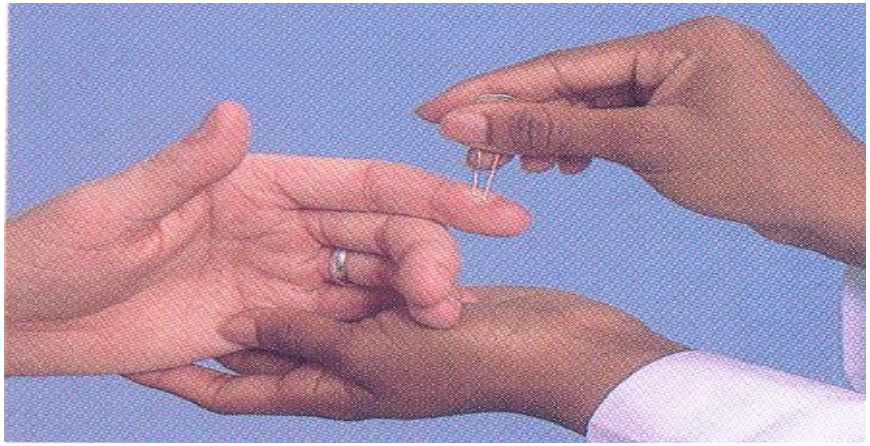
Proprioception

- Grasp toe by sides - pull away from other toes
- Demonstrate “up” & “down”

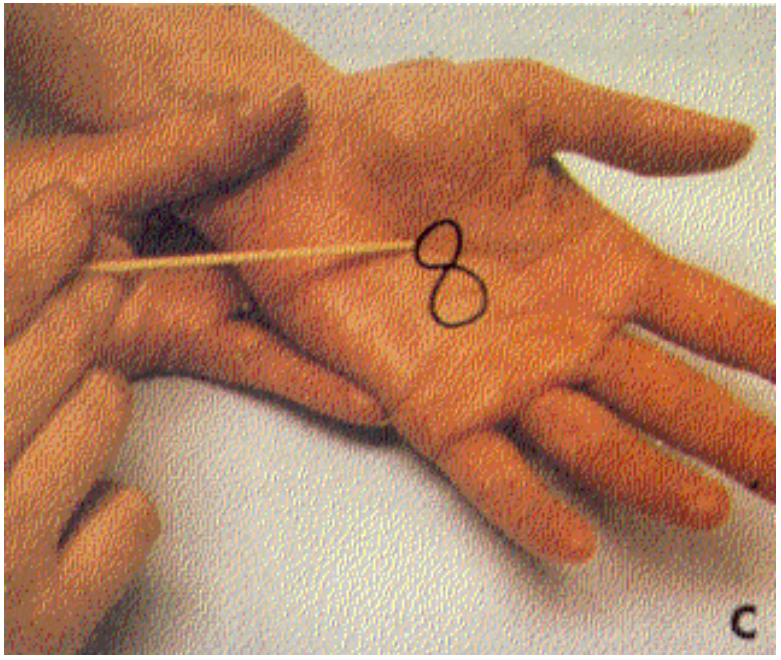


Tactile Localization

- Have pt close eyes
- Touch pt on R cheek & L arm
- Ask patient where touch was felt



Cortical Sensation

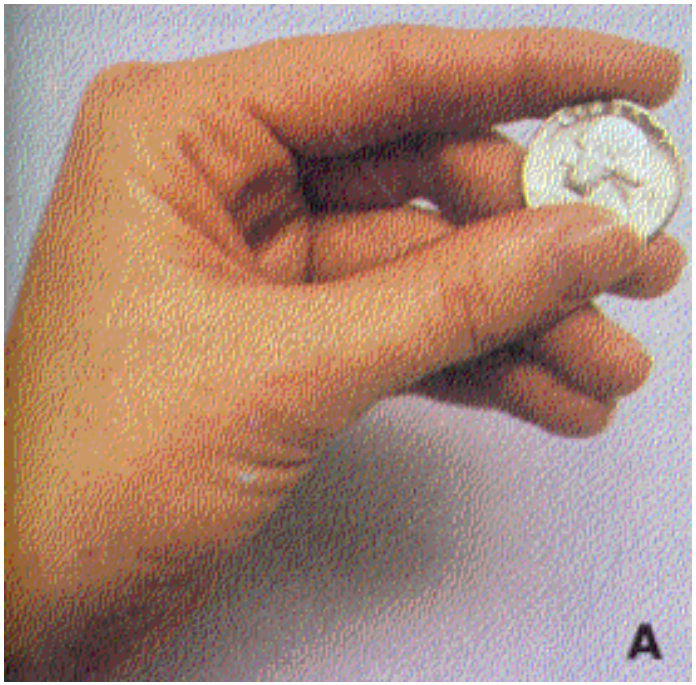


Discriminative Sensations

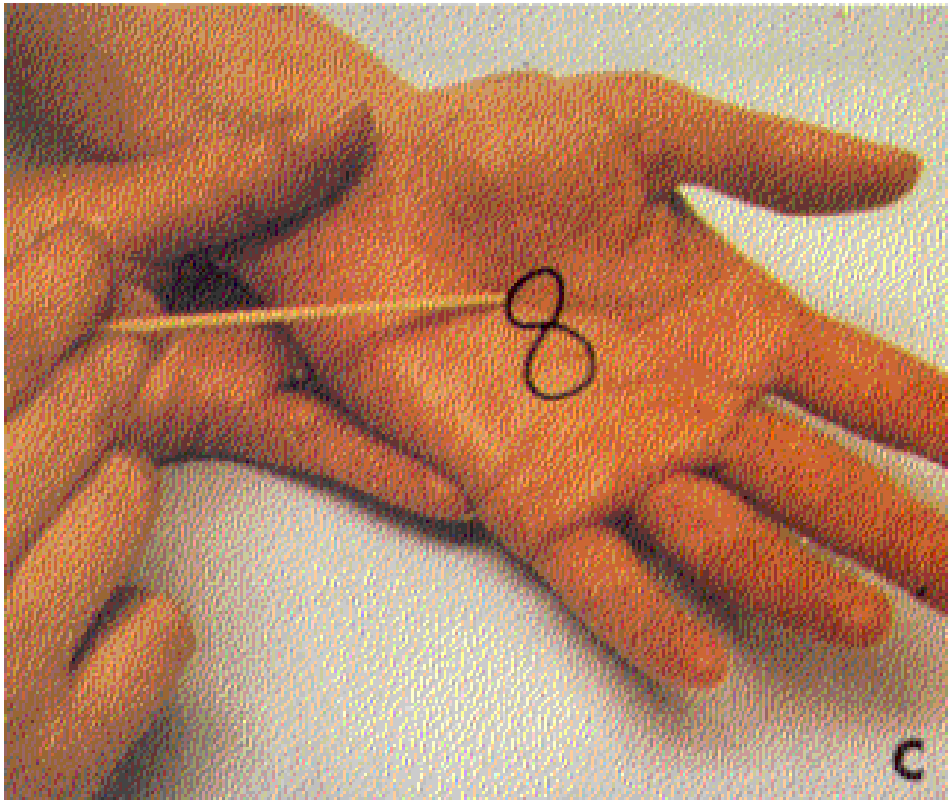
- Stereognosis, graphesthesia, two-point discrimination
- Test ability of sensory cortex to correlate, analyze, & interpret sensations
- Dependent on touch & position sense
- Screen first with stereognosis - proceed to other methods if indicated

Stereognosis

- Ability to identify an object by feeling it
- Place familiar object in patient's hand & ask patient to identify it
- Normally patient manipulates it skillfully & identifies it correctly

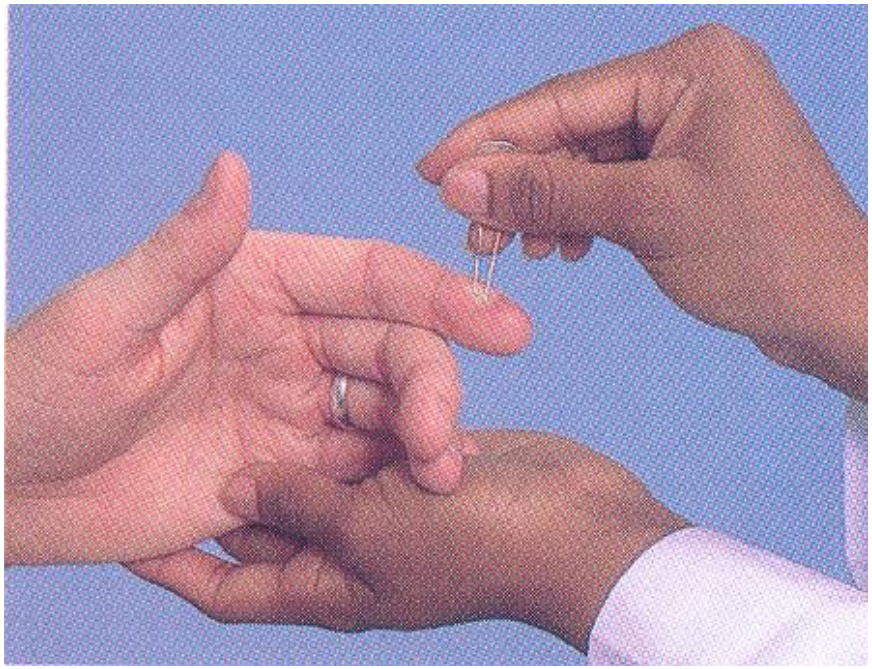


Graphesthesia



- Perform if inability to manipulate object
- Ability to identify numbers written in hand
- Use patient's orientation

Two-Point Discrimination



- Touch two places simultaneously
- Alternate stimuli
- Avoid pain
- Determine distance