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Practical Notes Contents

Select a practical title to jump to its first page.

Haemoglobin and Red Cell Indices	3
Red and White Cell Counts and Differential	6
ABO and Rh Grouping and Haemostasis Demonstration	8
Skeletal Muscle Ergography	11
Pulse and Blood Pressure at Rest and With Posture	13
Recording and Reading a Normal ECG	16
Cardiovascular Examination of a Volunteer	19
Spirometry and Lung Function Interpretation	22
Respiratory Examination of a Volunteer	25
Abdominal Examination of a Volunteer	28
Motor Sensory Reflex and Higher Function Examination	30
Cranial Nerve and Special Senses Screening	33
Reflex Traces and Sensory Physiology	36

Haemoglobin and Red Cell Indices

Practical 01 / Teaching laboratory

Aim

Measure or interpret haemoglobin, haematocrit and red cell indices in an approved teaching sample.

Principle

Haemoglobin measures the oxygen-carrying protein concentration. Haematocrit is the red cell volume fraction. The two measures and the red cell count provide different information.

Materials and Requirements

- Simulated blood count and packed-cell-volume readings
- Approved haemoglobin method or analyser display
- Reference and quality control records

Procedure

1. Verify the sample identity, method and units. Check instrument or reference controls before accepting values.
2. Set up the worksheet with columns for haemoglobin in g/dL, haematocrit in percent and RBC count in millions per microlitre. Check whether any value requires conversion.
3. Read haemoglobin and haematocrit from the authorised demonstration and record the raw red cell count.
4. In a packed cell demonstration distinguish the red cell column from the buffy coat and plasma. Use the supplied scale and record the proportion as a percentage if that convention is required.

Continue with step 5 on the next page.

Procedure Continued

Haemoglobin and Red Cell Indices

5. Compute MCV in fL as haematocrit × 10 divided by RBC count. Compute MCH in pg as haemoglobin × 10 divided by RBC count. Use the same RBC concentration units for both.
6. Compute MCHC in g/dL as haemoglobin × 100 divided by haematocrit in percent. Calculate before rounding, then cross-check the arithmetic against the example.
7. Compare each result independently with its laboratory interval. Flag inconsistent inputs or an implausible index for confirmation before describing the red cell pattern.
8. Relate the pattern to the supplied reference interval and write one reason an independent smear may be useful.
9. Enter calculated values and units next to the raw data. Give a short morphology statement supported by the indices and distinguish a possible cause from the measured pattern.

Precautions

- Use approved prepared material. Follow local specimen and sharps rules if a demonstration uses clinical material.
- Convert a decimal haematocrit to percent before applying the displayed formula.

Observations and Interpretation

Haemoglobin and Red Cell Indices

Observations and Record

Item	What to record	What it tells you
Haemoglobin	g/dL and method	Quantifies haemoglobin concentration
Haematocrit	Percent or L/L	Use the correct basis in calculations
Red cell indices	MCV, MCH and MCHC	Characterise cell size and haemoglobinisation

Worked Example

With Hb 12 g/dL, haematocrit 36% and RBC 4.0 million/µL, MCV = 36 × 10 / 4 = 90 fL. MCH = 12 × 10 / 4 = 30 pg. MCHC = 12 × 100 / 36 = 33.3 g/dL.

Result and Interpretation

Report the indices with units and relate them to the blood picture. Use laboratory intervals appropriate to the case.

Viva Questions and Answers

What does MCV represent?

Average red cell volume.

Why record the RBC units?

The displayed index factors assume millions of cells per microlitre.

Red and White Cell Counts and Differential

Practical 02 / Teaching laboratory

Aim

Calculate red and total white cell counts from chamber data and interpret a differential.

Principle

Chamber counting estimates cells per unit of original blood from cells in a known diluted volume. A differential gives relative proportions, which can be expressed as absolute counts.

Materials and Requirements

- Grid diagrams and supplied chamber counts
- Prepared blood smear or anonymised digital fields
- Calculator

Procedure

1. Identify the chamber squares, depth and effective counted volume using the supplied grid.
2. On the ruled teaching grid, outline the areas to be counted for red and white cells separately. Multiply the area by the stated depth to find the counted volume.
3. Apply a consistent boundary inclusion rule and reject an invalid or unevenly filled teaching chamber.
4. Count cells touching the top and left boundaries and omit the bottom and right borders, or use the course's equivalent convention consistently. Check the duplicate field or side for agreement.
5. Calculate the cell concentration from count × dilution factor ÷ counted volume in µL.
6. Use the dilution factor for that cell type and retain the counted volume in microlitres. Work through one count by hand, then verify units and compare the duplicate calculation.
7. In the prepared smear choose the monolayer where cells lie mostly apart. Scan at low power, then classify white cells in successive non-overlapping fields at the taught magnification.
8. Keep a running tally by cell type. Divide each tally by the total classified and multiply by 100. Multiply the total white cell count by the relevant fraction for an absolute count.
9. Record the total counted, any abnormal or uncertain forms and discrepancies between fields. Confirm unexpected patterns with the instructor before reporting.

Precautions

- Use only the approved laboratory or prepared field set.
- Account for the actual volume counted and avoid double-counting boundary cells.

Observations and Interpretation

Red and White Cell Counts and Differential

Observations and Record

Item	What to record	What it tells you
Red cell count	Cells, dilution and chamber volume	Convert to cells/µL
Total white cell count	Cells, dilution and chamber volume	Check convergence of replicate counts
Differential	Cell category, percent and absolute count	Distinguishes fraction from concentration

Worked Example

An illustrative white cell count of 160 in 0.40 µL at 1:20 dilution is 8,000 cells/µL. With 60% neutrophils, the absolute neutrophil count is 4,800 cells/µL.

Result and Interpretation

Report the chamber area, computed volume, dilution and differential basis with the result.

Viva Questions and Answers

Why multiply by the dilution factor?

The counted chamber contains diluted material.

Why calculate absolute counts?

A percentage can change even when the absolute number of that cell type stays the same.

ABO and Rh Grouping and Haemostasis Demonstration

Practical 03 / Teaching laboratory

Aim

Identify an ABO/RhD reaction pattern and interpret legacy bleeding and clotting time teaching records.

Principle

Forward grouping detects red cell antigens. In appropriate samples, reverse grouping helps check expected ABO antibodies. Bleeding and clotting times are historical teaching tests with limitations.

Materials and Requirements

- Non-biological blood grouping trainer or validated recorded reactions
- Recorded bleeding, clotting and coagulation results

Procedure

1. Identify the anti-A, anti-B and anti-D reaction fields and verify the control and reading method.
2. On the non-biological trainer label the reaction areas and match the cards to the correct identifiers. Keep reaction areas separate and use the demonstration's own controls and reading interval.
3. Read forward grouping from the anti-A and anti-B reaction areas. Compare serum reactions with the labelled A and B reagent cells in the reverse grouping example.
4. Assess the anti-D reaction separately with the required control. Mark a mixed field, weak reaction or disagreement as unresolved and refer it to the instructor.

Continue with step 5 on the next page.

Procedure Continued

ABO and Rh Grouping and Haemostasis Demonstration

5. Read anonymised bleeding-time and clotting-time records and describe their different endpoints.
6. In each historical haemostasis record identify the start time, documented endpoint and elapsed interval. Record units and flag missing or unreadable observations.
7. Compare those historical endpoints with the purpose of platelet assessment, PT and aPTT using supplied reports.
8. Read the supplied PT and aPTT against the printed laboratory intervals. Compare the recorded platelet count and identify which finding assesses cell number or clot formation in the reported method.
9. Write the ABO and RhD interpretation only for a concordant panel with valid controls. Record haemostasis findings in a separate field and state the limits of the historical tests.

Precautions

- Use simulation for learner grouping and historical bleeding-time data. Avoid a teaching skin incision.
- Treat weak or discrepant reactions as unresolved and refer them to the laboratory.

Observations and Interpretation

ABO and Rh Grouping and Haemostasis Demonstration

Observations and Record

Item	What to record	What it tells you
Forward ABO	Anti-A and anti-B reactions	Establishes red cell antigen pattern
RhD and controls	Anti-D and valid control results	Read under the stated method
Haemostasis	Method and observation endpoint	Distinguishes primary haemostasis and coagulation assessment

Worked Example

A supplied adult panel has anti-A positive, anti-B negative and anti-D positive with valid controls and concordant reverse grouping. The teaching interpretation is A RhD positive.

Result and Interpretation

State the supported group and describe why transfusion requires an approved identity and compatibility workflow.

Viva Questions and Answers

What is reverse grouping?

It tests plasma against known reagent red cells to help verify the ABO group.

Is blood group alone a compatibility decision?

Transfusion requires product and patient identity, antibody and other compatibility checks.

Skeletal Muscle Ergography

Practical 04 / Teaching laboratory

Aim

Measure external work in a standardised ergography exercise or supplied trace.

Principle

The work of lifting a constant load against gravity equals its weight multiplied by the total vertical displacement. Fatigue can reduce the height reached on successive contractions.

Materials and Requirements

- Supervised ergograph or supplied calibrated trace
- Known load and displacement scale
- Recording sheet

Procedure

1. Check scale, zero and mass. Record starting posture and the planned cadence.
2. Verify the vertical scale and starting baseline without movement. Confirm the assigned resistance and supervised posture for the teaching run before starting.
3. Record or read successive vertical lift distances in metres using consistent landmarks.
4. Begin at the preset cue and take a consistent baseline-to-peak measurement from each accepted lift. Mark an incomplete lift or sensor disturbance on the trace.
5. Record the lift number, displacement and timing in a table. Convert centimetres to metres and confirm that the lab's trace corresponds to actual vertical displacement.
6. Add the displacements against the stated load and calculate gravitational work.
7. Convert mass to force using the stated gravitational acceleration. Multiply by each displacement or the summed displacement for a constant load and report work in joules.
8. Compare early and later lift amplitudes with workload and cadence held constant.
9. Compare the first and last set of lifts made under matching conditions. Describe the amplitude change and record pauses, technique changes or tracing problems that affect the comparison.

Precautions

- Keep testing within instructor-approved effort and stop if painful.
- Distinguish external mechanical work from metabolic energy expenditure.

Observations and Interpretation

Skeletal Muscle Ergography

Observations and Record

Item	What to record	What it tells you
Load	Mass in kg and force in newtons	Force = mass × gravitational acceleration
Displacement	Sum of vertical lifts in metres	Use total measured distance
Work and fatigue	Joules and change in trace amplitude	Describes external work and trace behaviour

Worked Example

A 1.0 kg load lifted through a total vertical distance of 0.30 m gives 1.0 × 9.81 × 0.30 = 2.94 J of external work.

Result and Interpretation

Report cumulative work and interpret the trace pattern within the stated effort and recording conditions.

Viva Questions and Answers

What unit is used for work?

The joule, equivalent to one newton metre.

What can alter the trace besides fatigue?

Effort, cadence, friction or changes in starting posture.

Pulse and Blood Pressure at Rest and With Posture

Practical 05 / Supervised clinical examination

Aim

Measure pulse and blood pressure under defined resting and approved postural or exercise conditions.

Principle

Heart rate and vessel tone respond to posture and effort. Cuff size, body position, recovery time and technique affect comparability.

Materials and Requirements

- Validated upper-arm BP device and correct cuffs
- Watch, stethoscope and supervised activity protocol

Procedure

1. Ask permission, confirm suitability for the task and allow quiet seated rest. Support the bare upper arm at heart level.
2. Keep the back supported, feet flat and legs uncrossed. After at least five minutes of quiet seated rest for the resting reading, select the cuff from the stated arm circumference range.
3. Record radial pulse rate and rhythm. If irregular, count over a full minute and seek supervisor confirmation.
4. Use the pads of the fingers over the radial artery without excessive pressure. Note pulse volume and compare the count with a timer before documenting in beats per minute.
5. Measure pressure with the correctly sized cuff. For the auscultatory method identify the onset and disappearance of Korotkoff sounds as taught.

Continue with step 6 on the next page.

Procedure Continued

Pulse and Blood Pressure at Rest and With Posture

6. Position the cuff on the bare arm with its marker over the brachial region. For manual readings obtain the palpatory estimate and use the instructed inflation and deflation method. Record first and last heard sounds with units.
7. Take a repeat resting reading at the specified interval with the same arm and position. If the values differ appreciably, check posture, cuff and technique with the supervisor.
8. Repeat at defined times after an approved posture change or mild exercise. Record conditions, symptoms and repeat readings.
9. For the postural station, record blood pressure and pulse after five minutes lying down. Help the volunteer stand and repeat at one minute and three minutes. Support the arm at heart level, note symptoms and stop safely if the volunteer feels unwell.
10. Report dizziness or a fall of at least 20 mmHg systolic or 10 mmHg diastolic from the lying reading. In the mild-exercise station, record workload, measurement times and recovery using the supervisor’s protocol.

Precautions

- Stop a supervised exercise station for chest discomfort, dizziness, marked breathlessness or the instructor’s stop criteria.
- Avoid diagnosis from one reading.

Observations and Interpretation

Pulse and Blood Pressure at Rest and With Posture

Observations and Record

Item	What to record	What it tells you
Resting state	Posture, arm, cuff, pulse and BP	Provides baseline
Change condition	Posture or workload and time of reading	Makes the comparison reproducible
Recovery	Pulse, BP and symptoms	Distinguishes expected recovery from concerning findings

Worked Example

A fictional lying BP of 124/78 mmHg gives a pulse pressure of 46 mmHg. At one minute standing, BP is 100/68 mmHg with lightheadedness. Support the volunteer, stop the exercise and report a fall of 24 mmHg systolic and 10 mmHg diastolic.

Result and Interpretation

Report values with the measurement conditions and consider repeat clinical assessment when readings or symptoms are concerning.

Viva Questions and Answers

What does pulse pressure equal?

Systolic pressure minus diastolic pressure.

Why match cuff size to arm size?

An incorrectly sized cuff can bias the measured pressure.

Recording and Reading a Normal ECG

Practical 06 / Supervised clinical examination

Aim

Acquire a supervised resting ECG and interpret the calibration, rate, rhythm and basic intervals.

Principle

An ECG records electrical potential differences. Misplaced leads and motion can imitate abnormal findings.

Materials and Requirements

- ECG trainer or approved ECG recorder
- Electrode placement diagram
- Teaching trace with grid and calibration

Procedure

1. Confirm identity, privacy and consent. Check tracing speed and gain and place standard leads using the device diagram and instructor guidance.
2. Ask the volunteer to rest and keep the limb and chest electrode sites accessible with privacy preserved. Prepare dry contact areas and check that each cable label matches the assigned site.
3. On the trainer place V1 in the fourth intercostal space at the right sternal border and V2 at the same level on the left. Place V4 in the fifth left intercostal space on the midclavicular line, then set V3 halfway between V2 and V4.
4. Keep V5 and V6 on the same horizontal level as V4. Place V5 on the left anterior axillary line and V6 on the left midaxillary line. Check the limb electrodes against the cable labels before recording.

Continue with step 5 on the next page.

Procedure Continued

Recording and Reading a Normal ECG

5. Acquire an artefact-free tracing and verify correct lead labels. Record posture and time.
6. Check that the printed calibration matches the device settings, typically 25 mm/s and 10 mm/mV. Inspect the tracing for baseline drift, muscle interference, detached leads and incorrect placement.
7. Assess rate and regularity, then look for one P wave before each QRS with a consistent PR interval in an appropriate lead.
8. Use the large-square method for a regular rhythm or count complexes over a known strip duration for an irregular trace. Examine several beats in a lead with clear P waves.
9. Measure PR and QRS duration and document a structured rate, rhythm and interval summary.
10. Measure PR from P onset to QRS onset and QRS from its first to last deflection. Record paper speed, gain and measured durations, and review uncertain findings with the instructor.

Precautions

- Use privacy and a chaperone where appropriate.
- Distinguish artefact from genuine variation and ask the supervisor to review an unexpected trace.

Observations and Interpretation

Recording and Reading a Normal ECG

Observations and Record

Item	What to record	What it tells you
Calibration	Paper speed and gain	Required for time and amplitude
Rhythm	P waves, QRS relation and regularity	Supports sinus origin
Intervals	PR, QRS and relevant QT context	Characterises conduction

Worked Example

At 25 mm/s, one small 1 mm box represents 0.04 s. An R-R interval of 4 large boxes gives 300/4 = 75 beats/min in a regular rhythm.

Result and Interpretation

Report whether the illustrative pattern supports sinus rhythm and list any technical limitations.

Viva Questions and Answers

Why confirm the paper speed?

The same number of boxes may represent a different time interval.

What does the QRS complex chiefly represent?

Ventricular depolarisation.

Cardiovascular Examination of a Volunteer

Practical 07 / Supervised clinical examination

Aim

Take a brief cardiovascular history and demonstrate the normal inspection, palpation and auscultation sequence.

Principle

Pulse, blood pressure, neck veins, precordial impulses and sounds represent complementary aspects of cardiovascular function.

Materials and Requirements

- Consenting volunteer or simulator
- Stethoscope, BP device and observation sheet

Procedure

1. Ask about relevant symptoms and obtain permission. Check pulse, blood pressure, peripheral signs and oedema where appropriate.
2. Explain each area that will be examined and use hand hygiene and suitable draping. Record pulse rate, rhythm and blood pressure with posture and appropriate cuff information.
3. Position the volunteer comfortably and inspect the neck veins with the instructor.
4. Position the upper body at about 30 to 45 degrees initially and use tangential light. Ask the instructor to help distinguish visible venous pulsation from the arterial pulse before describing its level.

Continue with step 5 on the next page.

Procedure Continued

Cardiovascular Examination of a Volunteer

5. Inspect and gently palpate the precordium, locating an apex impulse when palpable and checking for additional impulses.
6. Locate the apex area by intercostal space and relation to the midclavicular line. Compare apex character and parasternal movement and feel gently for a palpable thrill when indicated.
7. Listen systematically at standard valve areas and time heart sounds with a peripheral pulse if needed.
8. Use a consistent order through aortic, pulmonary, tricuspid and mitral listening areas. Identify S1 and S2 and record the location, timing and quality of any additional sound.
9. Review bases and peripheral oedema with supervision where appropriate. Present vital signs, apex position, heart sounds and significant findings in sequence and thank the volunteer.

Precautions

- Palpate only one carotid at a time if taught and indicated.
- Keep exposure limited and re-cover the volunteer promptly.

Observations and Interpretation

Cardiovascular Examination of a Volunteer

Observations and Record

Item	What to record	What it tells you
Peripheral examination	Pulse, BP and oedema	Reports systemic findings
Precordium	Apex position and impulses	Describes location and character
Auscultation	S1, S2 and added sounds	Document the position where each was heard

Worked Example

In a simulated normal adult, S1 precedes the palpable carotid upstroke and S2 follows systole. Record which site and position helped identify each sound.

Result and Interpretation

Present the normal findings and mention areas where the signal was limited by examination conditions.

Viva Questions and Answers

What does S1 mark?

Closure of the atrioventricular valves around the onset of systole.

Why relate a sound to timing?

It helps distinguish systolic from diastolic findings.

Spirometry and Lung Function Interpretation

Practical 08 / Teaching laboratory

Aim

Obtain a technically acceptable supervised spirometry demonstration and interpret the flow and volume data.

Principle

FEV1 is the forced expiratory volume in the first second. FVC is forced vital capacity. An abnormally low FEV1/FVC supports airflow obstruction when effort and quality criteria are met.

Materials and Requirements

- Spirometer, approved filters and quality records
- Instructor screening checklist and reference equations
- Supplied curves if a volunteer is unsuitable

Procedure

1. Check identification, age, height and reference basis. Screen for contraindications and verify the equipment check.
2. Enter age, standing height and other data required by the reference set. Verify the calibrated device, single-use mouthpiece or filter and a seated position. Use simulated traces when participation is unsuitable.
3. Coach a maximal inspiration and prompt sustained exhalation using the device protocol. Record the effort and curve quality.

Continue with step 4 on the next page.

Procedure Continued

Spirometry and Lung Function Interpretation

4. Demonstrate a nose clip and firm mouth seal. Coach a full inspiration followed without delay by a fast, forceful start and continued exhalation under the instructor's stopping rule.
5. Compare acceptable manoeuvres and assess repeatability under the applicable technical standard.
6. Review the volume-time and flow-volume curves for cough in the first second, leaks, hesitant start or early termination. Retain the manoeuvres meeting the adopted quality criteria.
7. Provide recovery time and repeat with coaching to obtain acceptable, repeatable efforts under the lab standard. Record the best reportable FEV1 and FVC and the quality grade or limitations.
8. Calculate the ratio and review it against the appropriate lower limit of normal and the curve shape.
9. Divide FEV1 by FVC and compare with the supplied lower limit of normal. A low FVC with a preserved ratio warrants review of technique and lung volume data before assuming restriction.

Precautions

- Use infection control and pause when symptoms occur.
- Avoid interpretation of unaccepted or poorly repeated manoeuvres.

Observations and Interpretation

Spirometry and Lung Function Interpretation

Observations and Record

Item	What to record	What it tells you
FEV1 and FVC	Litres, manoeuvre quality and reference basis	Assess individual results
FEV1/FVC	Observed ratio and lower limit of normal	Supports or argues against obstruction
Curve quality	Cough, early termination or poor start	Marks interpretation limits

Worked Example

Teaching data FEV1 2.40 L and FVC 3.20 L give 0.75 or 75%. Interpret against an appropriate reference and check acceptability before classifying the pattern.

Result and Interpretation

Record quality and values before stating a pattern. A low FVC alone does not establish restriction.

Viva Questions and Answers

What confirms a restrictive ventilatory defect?

A reduced total lung capacity on appropriate testing.

Why see the flow-volume curve?

It helps detect technical faults and supports pattern interpretation.

Respiratory Examination of a Volunteer

Practical 09 / Supervised clinical examination

Aim

Demonstrate respiratory inspection, palpation, percussion and auscultation in a normal or simulated subject.

Principle

Comparison of symmetrical points helps detect regional changes. Different findings arise from changes in air, fluid, consolidation or airway calibre.

Materials and Requirements

- Consenting volunteer or manikin
- Stethoscope and chart of paired examination sites

Procedure

1. Ask about breathlessness, cough and relevant symptoms and check general appearance and respiratory rate.
2. Confirm consent, seat the volunteer comfortably and expose matched chest areas while maintaining privacy. Observe the respiratory rate at rest for a full minute when irregular.
3. Inspect chest symmetry and breathing effort. Compare chest movement gently at equal levels.
4. Inspect shape, accessory muscle use and chest wall movement from front and back. Assess expansion at matching lower chest levels and note any consistent asymmetry.

Continue with step 5 on the next page.

Procedure Continued

Respiratory Examination of a Volunteer

5. Percuss comparable interspaces in a systematic order and compare the resulting notes.
6. Place the pleximeter finger firmly in an interspace and tap it lightly. Compare corresponding sites side to side from upper to lower zones and avoid the scapulae when seeking lung resonance.
7. Auscultate corresponding sites. Describe breath sound quality and any added sound, timing and location.
8. Use the diaphragm on bare skin and listen over comparable anterior and posterior zones for at least one complete cycle at each site. Ask for gentle mouth breathing and pause if the volunteer feels dizzy.
9. Describe a suspected difference by side, level and respiratory phase, then confirm it on a repeat comparison. Record any area omitted and clean the stethoscope.

Precautions

- Stop for respiratory distress and contact the supervising team.
- Avoid asking a breathless subject to repeatedly take deep breaths.

Observations and Interpretation

Respiratory Examination of a Volunteer

Observations and Record

Item	What to record	What it tells you
Breathing pattern	Rate, symmetry and effort	Defines baseline and work of breathing
Percussion	Resonant or altered note and location	Helps identify regional change
Breath sounds	Character, symmetry and added sounds	Correlates with inspection and percussion

Worked Example

Symmetrical movement, comparable resonance and bilateral vesicular breath sounds support a normal teaching examination. A focal clue should be confirmed against nearby and contralateral sites.

Result and Interpretation

Give a brief sequence of normal and abnormal findings in the same documented order.

Viva Questions and Answers

Why compare paired sites?

It helps detect asymmetry and reduces technique differences.

What makes crackles useful to describe?

Their timing, location and change with manoeuvres can guide the differential.

Abdominal Examination of a Volunteer

Practical 10 / Supervised clinical examination

Aim

Take a focused digestive history and demonstrate a systematic abdominal examination.

Principle

Inspection, auscultation, percussion and palpation answer different questions. A gentle sequence and awareness of tenderness protect comfort.

Materials and Requirements

- Consenting volunteer or simulator
- Stethoscope and anatomical region chart

Procedure

1. Ask about pain, appetite, distension and bowel changes. Explain the examination and ensure privacy.
2. Ask where any discomfort is greatest and whether movement worsens it. Explain inspection, listening and gentle palpation and record permission before exposing the abdomen.
3. Position the volunteer supine and inspect all regions, noting contour and movement.
4. Place the volunteer supine with head supported and arms relaxed. Inspect from the end and side for symmetry, visible scars, distension and movement with breathing.
5. Practise the taught auscultation and percussion sequence. Identify areas of relative tympany and dullness.
6. Listen as taught before percussion and palpation. Work systematically through the abdomen, describing sound and percussion notes by region and stopping if the volunteer is uncomfortable.
7. Begin gentle palpation away from any reported pain. Identify normal landmarks and present findings with region and tenderness.
8. Warm the hands and begin light palpation away from discomfort while watching the volunteer's face. Progress to deeper palpation and supervised liver or spleen assessment only when appropriate.
9. Report contour, percussion, tenderness, masses and whether an organ edge is palpable. Record any incomplete part and avoid repeat painful manoeuvres.

Precautions

- Keep exposure limited and stop if the subject asks.
- Avoid repeated painful manoeuvres and refer acute pain or instability promptly.

Observations and Interpretation

Abdominal Examination of a Volunteer

Observations and Record

Item	What to record	What it tells you
Inspection	Contour, scars and visible movement	Documents baseline
Percussion and sounds	Region and reported character	Supports a structured description
Palpation	Tenderness, masses and organ findings	Communicates clinically relevant changes

Worked Example

Illustrative volunteer has a soft abdomen without reported tenderness. Describe that finding separately from whether the liver edge is palpable under the stated conditions.

Result and Interpretation

Describe the examination and one limitation, such as inability to interpret an isolated bowel sound as a diagnosis.

Viva Questions and Answers

Why begin away from pain?

It reduces discomfort and helps establish a baseline response.

What does percussion over gas commonly sound like?

Tympany is typical over gas-containing viscera.

Motor Sensory Reflex and Higher Function Examination

Practical 11 / Supervised clinical examination

Aim

Demonstrate higher function screening, motor examination, sensation, reflexes and coordination.

Principle

Findings localise when several modalities fit the same distribution. Usage of consistent positioning and side comparisons improves reliability.

Materials and Requirements

- Consenting volunteer or standardised patient
- Reflex hammer, cotton and tuning fork
- Examination record sheet

Procedure

1. Check alertness, orientation, speech and the ability to follow relevant commands.
2. Introduce the examination and ask about pain, weakness, sensory change and mobility support. Verify that the volunteer hears and understands the tasks.
3. Compare muscle bulk, tone and power by movement and side. Assess gait and coordination only when safe.

Continue with step 4 on the next page.

Procedure Continued

Motor Sensory Reflex and Higher Function Examination

4. Inspect for asymmetry or wasting, assess tone with supported passive movement and compare selected movements against resistance. Grade power with the taught scale.
5. Test one upper and lower limb coordination task as appropriate. If gait is safe, observe walking and turning with assistance available and record the pattern or reason it was omitted.
6. Compare light touch and vibration or joint position using the taught stimuli and a consistent pattern.
7. Demonstrate the sensory stimulus on unaffected skin. Ask the volunteer to close their eyes and describe what they feel. Compare matching sites and map the boundary of a finding.
8. Elicit representative deep tendon reflexes with relaxed positioning. Document symmetry and integrate the findings.
9. Support the limb and compare biceps, knee and ankle responses using the taught reflex positions. Record side, grade and reinforcement if used, then present the motor and sensory pattern.

Precautions

- Support the person during gait testing and avoid falls.
- Use approved noninjurious stimuli and avoid unnecessary exposure.

Observations and Interpretation

Motor Sensory Reflex and Higher Function Examination

Observations and Record

Item	What to record	What it tells you
Higher functions	Orientation, attention and language	Screens cognitive functions
Motor and reflexes	Power by movement, tone and side	Supports pathway localisation
Sensation and coordination	Modalities, distribution and observed performance	Distinguishes focal and diffuse patterns

Worked Example

A fictional unilateral pattern of weakness and brisk reflexes may suggest an upper motor pathway problem. Compare tone, plantar response and distribution before localising.

Result and Interpretation

Record tested functions and side. Explain which findings fit an anatomical pathway rather than listing an unsupported diagnosis.

Viva Questions and Answers

What makes side comparisons useful?

They help identify asymmetry under similar technique.

What is proprioception?

Awareness of joint position and movement.

Cranial Nerve and Special Senses Screening

Practical 12 / Supervised clinical examination

Aim

Screen cranial nerve functions and report the method and laterality of findings.

Principle

Cranial nerves can be tested using visual, ocular motor, facial, hearing and bulbar tasks. Findings are most useful when described as functions and compared on both sides.

Materials and Requirements

- Standardised patient or volunteer
- Penlight, visual target and optional tuning fork
- Nerve function checklist

Procedure

1. Check vision and confrontation fields as taught, then compare pupils and direct and consensual responses.
2. Ask about visual, auditory and swallowing symptoms and obtain consent. Confirm corrective lenses if needed and test each eye separately for acuity and gross fields.
3. Inspect pupil sizes in even light. Bring a small light from the side to check the direct and consensual constriction and note the eye tested and any asymmetry.
4. Test ocular movements, asking about diplopia and observing any movement limitation or nystagmus.

Continue with step 5 on the next page.

Procedure Continued

Cranial Nerve and Special Senses Screening

5. Hold the target at a comfortable distance. Ask the volunteer to keep the head still and follow it through the standard gaze positions. Stop on sustained discomfort or diplopia and record the direction.
6. Compare facial sensation and movement, and use an appropriate screening method for hearing.
7. Compare light touch across facial divisions and ask for eyebrow elevation, tight eye closure and smiling. Check each ear using the approved hearing screen and describe any limitation.
8. Observe voice, palate movement, shoulder shrug and tongue movement as appropriate to the station.
9. Observe voice quality, palate elevation, shoulder shrug and tongue position or movement as appropriate. Report abnormal findings with their side, associated signs and the nerve pathway that may be involved.

Precautions

- Avoid forceful or irritating stimuli. Use a model or supplied findings for invasive or distressing tests.
- Escalate acute new focal findings to the supervisor.

Observations and Interpretation

Cranial Nerve and Special Senses Screening

Observations and Record

Item	What to record	What it tells you
Vision and pupils	Acuity or fields and light responses	Records afferent and efferent clues
Eye movements and face	Deviation, diplopia or asymmetry	Localises cranial function
Hearing and bulbar function	Method and side	Supports an organised report

Worked Example

A simulated right eye fails to abduct on right gaze. Confirm that the finding is consistent and assess the remaining movements before presenting a possible right abducens pathway deficit.

Result and Interpretation

Summarise which functions were tested, any laterality and why a follow-up examination may be needed.

Viva Questions and Answers

What limb of the pupil light reflex does the optic nerve carry?

The afferent visual input.

Which muscle abducts the eye?

Lateral rectus, supplied by cranial nerve VI.

Reflex Traces and Sensory Physiology

Practical 13 / Report and data interpretation

Aim

Interpret a teaching reflex record and compare sensory pathway results.

Principle

A reflex uses a receptor, afferent pathway, central connections, an efferent pathway and an effector. Latency includes travel and synaptic or muscular delays.

Materials and Requirements

- Annotated reflex and sensory records
- Skin territory and spinal pathway diagrams
- Timing ruler

Procedure

1. Identify stimulus onset, response onset and scale on a supplied trace.
2. Confirm tracing units, stimulus channel and response channel. Use two known grid marks to verify the time scale and distinguish the stimulus artefact from the genuine response.
3. Calculate latency and compare matched repeats without using a single trace as a diagnosis.
4. Use the marked onset of the first reproducible deflection and subtract the stimulus time. Convert seconds to milliseconds and record the measured latency for each comparable trial.
5. Compare latencies and response amplitudes only for matching recordings. Identify a noisy or clipped trace, document exclusions and repeat the reading on a valid trace.
6. Map a supplied sensory change to a peripheral nerve, root or spinal tract pattern.
7. Place the fictional sensory change on a body chart. Compare it with a named nerve territory, dermatome and candidate spinal tract using the provided diagrams.
8. Present an explanatory diagram linking stimulus, pathway and response.
9. Diagram receptor, afferent, spinal integration, efferent and response for the assigned reflex. Summarise the observed timing and distribution and state what remains uncertain.

Precautions

- Check sampling and calibration before converting units.
- Use supplied traces for electrically evoked recordings.

Observations and Interpretation

Reflex Traces and Sensory Physiology

Observations and Record

Item	What to record	What it tells you
Trace	Stimulus and response timing	Allows latency calculation
Sensory modality	Touch, vibration or other modality	Relates to the appropriate pathway
Distribution	Side and anatomical boundaries	Suggests a localisation to test

Worked Example

If a supplied trace is marked at 0.10 s for stimulus and 0.14 s for response, latency is 0.04 s or 40 ms. The specific method determines whether this is expected.

Result and Interpretation

State the measured latency and identify the pathway features supported by the scenario.

Viva Questions and Answers

Why record stimulus onset?

Latency is timed from stimulus to response.

What does a reflex latency include?

Conduction and relevant central or effector delays.

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