

# **HYPOTENSIVE ANESTHESIA**

Dr. C.RADHA KISHAN RAO M.D;D.A  
PROFESSOR OF ANESTHESIOLOGY  
KIMS,NARKETPALLY

HYPOTENSIVE ANESTHESIA IS DEFINED AS PRODUCING DELIBERATE HYPOTENSION AFTER INDUCTION OF ANESTHESIA WITH INHALATIONAL AGENTS, VASODILATORS, GANGLION BLOCKING AGENTS, BETA BLOCKERS, POSTURE, IPPV AND PEEP, REGIONAL ANESTHESIA LIKE SPINAL, EPIDURAL, COMBINED SPINAL EPIDURAL TECHNIQUES IN NORMOVOLEMIC PATIENTS WITH PRESERVATION OF ORGAN FUNCTION.

- ❧ RIVAROCCHI INTRODUCED THE INFLATABLE ARMLET AND MERCURY MANOMETER AND SHOWED THE ENDPOINT OF SYSTOLE COULD BE DETERMINED BY PALPATION OF RADIAL ARTERY.
- ❧ CUSHING USED THE SIMPLE TECHNIQUE DURING SURGERY.
- ❧ IN 1905 KOROTKOFF DESCRIBED SOUNDS WHICH ARE WIDELY USED FOR THE DETERMINATION OF SYSTOLIC AND DIASTOLIC BLOOD PRESSURE.

## HISTORY

❧ CUSHING IN 1917 USING OBSERVED SUCH GREAT ADVANCES IN NEUROSURGICAL TECHNIQUES STRESSED HEMORRAGE AS ONE OF THE MANY COMPLICATIONS AS GREAT BLOOD LOSS INCREDIBLE AFTER LEADING TO DEATH OF PATIENT THAT SEVERE BLOOD LOSS RESULTS IN DRY FIELD.

❧ IN 1943 PAGE PRODUCED HEMORRAGIC HYPOTENSION IN ANIMALS AND REVERSAL BY INTRA ARTERIAL REINFUSION OF DRAINED BLOOD.

❧ IN 1946 GARDEN PRODUCED DELIBERATE REDUCTION OF BLOOD PRESSURE UNDERGOING DIFFICULT NEUROSURGICAL PROCEDURES. THIS TECHNIQUE PRODUCES STATE ALLIED TO SHOCK.

❧ IN 1950 GILLES PROVIDED GOOD OPERATING CONDITION BY ARTERIOTOMY. TWO DANGERS WERE VASOCONSTRICTION AND TISSUE HYPOXIA AND OLIGEMIC PATIENTS WERE IN STATE OF HEMORRAGIC SHOCK. DEATHS OCCURRED FROM IRREVERSIBLE SHOCK. NORMOVOLEMIC HYPOTENSION CAN BE ACHIEVED BY FOOT DOWN TILT TO LIMIT VENOUS RETURN.

## CONTRAINDICATIONS:

❧ LUNG COLLAPSE.

❧ ANEMIA.

- ❧ BLOOD LOSS IS MINIMISED AND BLOOD TRANSFUSION WITH ITS COMPLICATIONS ARE AVOIDED ALTOGETHER AS NUMBER OF UNITS TRANSFUSED ARE REDUCED.
- ❧ THE DURATION OF OPERATION IS CURTAILED. SURGEON HAS MUCH INCREASED VIEW OF OPERATIVE FIELD. LESS TIME IS REQUIRED FOR HEMOSTASIS. THE STRESS OF PROLONGED SURGERY IS REDUCED.
- ❧ ANATOMICAL STRUCTURES ARE MORE EASILY DEFINED IN THE DRY FIELD. ACCIDENTAL DAMAGE TO NERVES AND OTHER STRUCTURES ARE REDUCED. THE ACCURACY OF SURGICAL PROCEDURE IS ENHANCED.

## INDICATIONS

- ❧ BETTER OUTCOME FOR THE PATIENT WITH THE RESULT THE TUMOR BENIGN OR MALIGNANT OR INFECTIVE FOCUS WILL BE EXCISED WITH GREATER PRECISION AS THE PATHOLOGICAL TISSUE WITH VARIATION OF TEXTURE AND COLOUR ARE IDENTIFIED MORE EASILY THAN IN THE FIELD OF NORMOTENSIVE BLEEDING.
- ❧ LOCAL INFILTRATION OF SKIN AND SUBCUTANEOUS FAT WITH VASOCONSTRICTOR DRUGS IS WIDELY USED AND REDUCES THE BLEEDING IN SURGICAL FIELD.
- ❧ IT PRODUCES SWELLING AND DISCOLOURATION OF TISSUES WHICH MAY RESULT IN INACCURATE OPERATION WHEN A PROCEDURE AS IN TOTAL RECONSTRUCTION OF EYELID SURGICALLY WITH CONTROLLED HYPOTENSION DISFIGURATION CAN BE AVOIDED.



- ❧ IT CAUSES SIGNIFICANT FALL IN INTRAOCULAR PRESSURE. SURGICAL ACCESS TO TUMOR BEHIND EYEBALL IS MADE EASY AS THE FLACCID BALL CAN BE RETRACTED.
- ❧ TISSUE EDEMA IS LESS DUE TO INDUCED HYPOTENSION AND BLEEDING IS LESS DURING OPERATIVE AND POST OPERATIVE PERIOD. THE TISSUES ARE IN HEALTHIER AND NORMAL WOUND HEALING WILL PROCEED.
- ❧ WITH DELIBERATE HYPOTENSION THE REACTIONARY HEMORRAGE, POSTOPERATIVE BLEEDING AND HEMATOMA ARE LESS AFTER SURGERY.
- ❧ REDUCTION IN THE INCIDENCE OF POSTOPERATIVE WOUND INFECTION BY REDUCED BLEEDING.

## PREPARATION:

- ✧ PAC IS DONE 3-4 DAYS PRIOR TO SURGERY AND CONSENT WILL BE OBTAINED.
- ✧ SELECTION OF BETA BLOCKER TO CONTROL INCREASE IN HEART RATE.
- ✧ MAINTAIN Hb OF 10 gm%.
- ✧ PATIENT WILL BE GIVEN BENZODIAZEPINES ON THE NIGHT BEFORE SURGERY.
- ✧ PATIENT WILL BE KEPT NPO FROM 10 pm ONWARDS BEFORE NIGHT.

**PREPARATION**

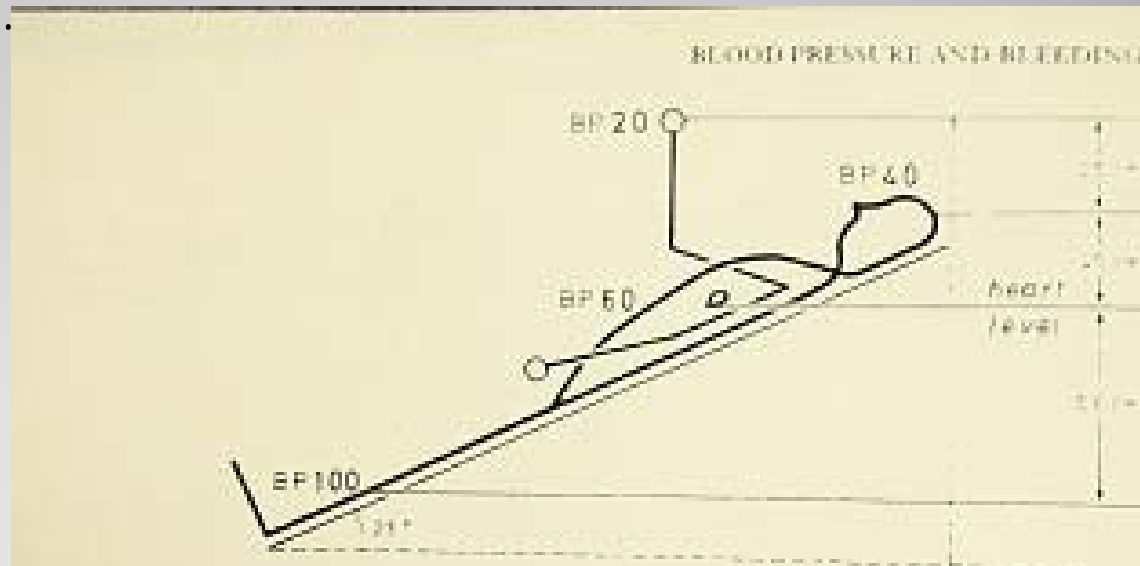
## TECHNIQUES:

- ❧ APPLYING TORNQUET FOR ARM AND THIGH WILL PRODUCE BLOODLESS SURGICAL FIELD. BELOW TORNQUET SURGERIES ARE FOREARM, HAND, LEG, FOOT SURGERIES AND VASCULAR TUMORS.
- ❧ THE APPLICATION OF TORNQUET SHOULD NOT EXCEED ISCHEMIC TIME. SO THE TIME SHOULD BE NOTED AT THE TIME OF TORNQUET APPLICATION AND SHOULD BE REMOVED BEFORE ISCHEMIC TIME.
- ❧ IN PDA HYPOTENSION TO SAFE LEVEL IS ESSENTIAL TO PREVENT TEARING OF VESSEL.

- ❧ HYPOTENSION IS PRODUCED BY INHALATIONAL AGENT PREFERRABLY HALOTHANE BY ITS DEPRESSANT EFFECTS ON MYOCARDIUM AND SINUS NODE.
- ❧ CONTINUOUS MONITORING IS ESSENTIAL. BP SHOULD BE REDUCED TO SYSTOLIC 70mm Hg OR 50 mm Hg BEFORE LIGATION OF PDA
- ❧ AFTERWARDS PRESSURE SHOULD BE BROUGHT TO NORMAL. THIS CAN BE ACHIEVED WITH USE OF BETA BLOCKERS, SODIUM NITRO PRUSSIDE AND AFTER TITRATION OF THESE AGENTS.
- ❧ THE AGENTS CAN BE CURTAILED AND BLOOD PRESSURE IS BROUGHT TO NORMAL.

- ❧ REGIONAL TECHNIQUES LIKE SPINAL, EPIDURAL, CSE PRODUCE DRY FIELD BELOW THE BLOCK FOR SURGERY ON LOWER LIMBS AND LOWER ABDOMEN.
- ❧ DURING TURP HYPOTENSION PRODUCES BETTER VIEW OF TUMOR AND BLEED WILL BE LESS AND ENABLES SURGEON FOR ADEQUATE CAUTERISATION TO SECURE HEMOSTASIS.

POSTURAL CHANGES: FOR EACH 2.5cm INCREASE IN VERTICAL HEIGHT WHEN TIPPED BLOOD PRESSURE FALLS BY 2mmHg, AND IN A FOOT DOWN TILT OF  $25^\circ$  WITH THE HEAD RAISED APPROXIMATELY 25 cm ABOVE HEART LEVEL, THERE WILL BE A REDUCTION IN LOCAL BP OF NEARLY 20 mmHg.



- ❧ CARDIAC OUTPUT IS DECREASED AND ARTERIOVENOUS OXYGEN DIFFERENCE IS INCREASED.
- ❧ JUGULAR BULB SAMPLING OF MIXED VENOUS BLOOD FROM BRAIN IS USED AS AN INDEX OF CEREBRAL PERFUSION.
- ❧ INSPIRED AND EXPIRED GASES ARE MEASURED BY BREATH BY BREATH BY MASS SPECTROSCOPY OR INFRA RED ANALYSIS.
- ❧ BLOOD GAS MEASUREMENT.

- ❧ PATIENT IS RECEIVED INTO THE PREPARATIVE AREA AND CONNECTED TO MONITORING DEVICES- ECG, PULSEOXIMETRY, NIBP AND BASE LINE VITALS ARE RECORDED.
- ❧ I.V LINE IS SECURED.
- ❧ PREMEDICATION GIVEN 30 min BEFORE SURGERY - Inj.MIDAZOLAM, Inj.ONDANSETRON, Inj.RANITIDINE. ANTICHOLINERGICS ARE AVOIDED AS THEY CAUSE TACHYCARDIA.

## CONDUCT OF ANESTHESIA



- ❧ INDUCTION: Inj. THIOPENTONE 3-5 mg/KG.
- ❧ INTUBATED WITH APPROPRIATE SIZED CUFFED ENDOTRACHEAL TUBE AFTER GIVING Inj. VECURONIUM 0.1mg/KG AND THEN PATIENT IS CONNECTED TO VENTILATOR.
- ❧ INTRA ARTERIAL AND CENTRAL VENOUS ACCESS ARE SECURED FOR BEAT TO BEAT MONITORING
- ❧ FOLLEY'S CATHETERISATION IS DONE FOR MONITORING URINE OUTPUT.

- ✧ ARTERIAL BLOOD GASES ARE MEASURED WHEN NEEDED.
- ✧ PATIENT IS MAINTAINED ON O<sub>2</sub> :N<sub>2</sub>O @ 2:3.
- ✧ WHEN HYPOTENSION IS NEEDED APPROPRIATE TECHNIQUE IS USED ALONG WITH O<sub>2</sub> :N<sub>2</sub>O @ 50%:50%.
- ✧ AFTER COMPLETION OF SURGERY BP IS BROUGHT TO NORMAL GRADUALLY.

- ❧ IN NEUROSURGERIES HYPOTENSION IS INDUCED AFTER OPENING OF CRANIUM.
- ❧ WHILE CLIPPING OF ANEURYSMS & FEEDING VESSELS OF AVM BP IS BROUGHT DOWN TO 40mm Hg FOR BRIEF PERIODS WHICH ENABLES SURGEON A CLEAR OPERATIVE FIELD AND SAFE SURGERY.

- ✧ AFTER COMPLETION OF SURGERY AND PATIENT STARTS RECOVERING FROM NEUROMUSCULAR BLOCKADE REVERSAL IS ADMINISTERED AND THEN PATIENT IS EXTUBATED.
- ✧ PATIENT IS SHIFTED TO PACU AND OBSERVED FOR 48 HOURS.

## TRIMETHAPHAN:

- ❧ PRODUCES HYPOTENSION BY GANGLION BLOCKING ACTION AND BY DIRECT VASODILATOR ACTION DUE TO HISTAMINE RELEASE.
- ❧ 1 TO 5 mg BY INFUSION, SHOULD NOT EXCEED 1gm/DAY.

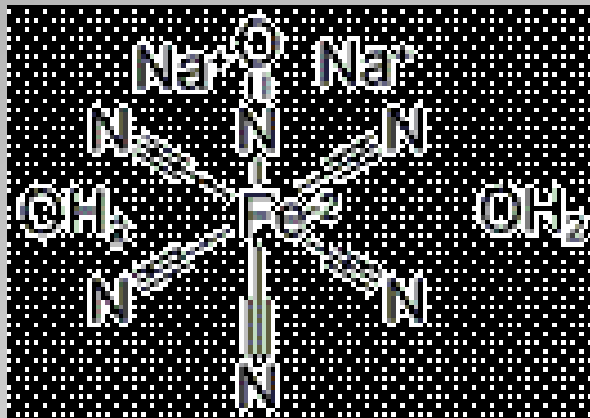
**PHARMACOLOGY**

❧ BETA ADRENERGIC BLOCKADE.

❧ ALPHA AND BETA ADRENERGIC  
BLOCKADE.

## SODIUM NITRO PRUSSIDE:

- ❧ IN 1929 JOHNSON FIRST ADMINISTERED SNP TO HUMAN PATIENTS.
- ❧ IT WAS USED BY PAGER IN 1951 AND MORECA AT 1962 SUCCESSFULLY BECAUSE OF ITS RAPID, TRANSIENT POTENT ACTION AND LIMITATION OF ACTION ONLY TO CVS AND NO TOXIC EFFECTS ON OTHER ORGANS AND RETURN OF NORMALISATION IS FREE FROM RESIDUAL SIDE EFFECTS SNP GAINED RAPID ACCEPTANCE AS HYPOTENSIVE AGENT.



THE IRON ATOM LIES CENTRALLY LOCATED. NITROSYL AND FIVE CYANIDE GROUPS ARE DISPOSED AROUND IT AT THE APICES OF OCTAHEDRON. ITS RED BROWN CRYSTALS ARE FORMED BY LATTICE OF THESE UNITS, WITH IN WHICH ARE TRAPPED SODIUM ATOMS AND WATER MOLECULES.



- ❧ THE CRYSTALS ARE SOLUBLE IN WATER AND SOLUTION HAS LIGHT PINK COLOUR.
- ❧ EXPOSURE OF SOLUTION TO LIGHT OR ALKALINISATION RESULTS IN FORMATION FROM FERRIC TO FERROUS FORM AND COLOUR CHANGES TO LIGHT BLUE SOLUTION.
- ❧ SUPPLIED AS 50 mg FREEZE DRIED POWDERED BASE. ITS ACTION STARTS WITH IN 30 SECONDS OF STARTING INTRAVENOUS INFUSION. THE DOSE OF SNP SHOULD NOT EXCEED 1.5mg/KG OVER SHORT PERIOD.

## USES:

### NEURO SURGERY:

- ⌘ CEREBRAL ANEURYSMS,
- ⌘ ARTERIOVENOUS MALFORMATIONS
- ⌘ VASCULAR TUMORS
- ⌘ CEREBRAL VASOSPASM
- ⌘ PHEOCHROMOCYTOMA

### INDICATIONS FOR PROLONGED ADMINISTRATION OF SNP:

- ⌘ PERSISTANT POSTOPERATIVE HYPERTENSION
- ⌘ PREECLAMPTIC TOXEMIA
- ⌘ ERGOT POISONING
- ⌘ MALIGNANT HYPERTENSION

- ❧ INTRA ARTERIAL MONITORING SHOULD BE DONE IN THE ICU.
- ❧ TOXIC DOSE OF CYANIDE MAY ACCUMULATE IF FLUID OVERLOADING MAY OCCUR.
- ❧ WHEN GIVEN LONGER THAN 48 HOURS DAILY ESTIMATION OF RED CELL CYANIDE AND PLASMA THIOCYANATE CONCENTRATION SHOULD BE MEASURED.
- ❧ METABOLIC ACIDOSIS, PLASMA CYANIDE CONCENTRATION OF 3mcg/L OR PLASMA CYANIDE LEVELS OF 1.7mcg/L ARE SIGNS OF CYANIDE TOXICITY.

- ❧ CHRONIC ADMINISTRATION OF SNP SHOULD NOT EXCEED 5mcg/KG/L CONCOMITANT SODIUM THIO SULPHATE INFUSION SHOULD BE GIVEN.
- ❧ SNP RECEIVES AN ELECTRON FROM OXYHEMOGLOBIN MOLECULE CAUSING THE MOLECULE TO BECOME UNSTABLE FORMING METHHEMOGLOBIN.
- ❧ UNSTABLE SNP REDUCES FIVE CYANIDE RADICALS ONE OF WHICH REACTS WITH HEMOGLOBIN FORMING CYANMET HEMOGLOBIN.THE OTHER FOUR IONS LINK WITH SULPHYDROL GROUP LOCATED IN ERYTHROCYTES.
- ❧ IT IS CATALYSED BY ENZYME RHODANASE OR IT IS ENZYMATIC.THE TOXIC CYANIDE IS CONVERTED INTO NONTOXIC COMPOUNDS CYANMET HEMOGLOBIN AND THIOCYANATE.

- ❧ NORMAL BIODEGRADATION OF CYANIDE REQUIRES A PLENTIFUL SUPPLY OF SH GROUPS. SNP OVER LOADING WILL LEAD TO ACCUMULATION OF CYANIDE IONS.
- ❧ THEY SWIFTLY COMBINE WITH CYTOCHROME OXIDASE AND STOPS AEROBIC TISSUE RESPIRATION, METABOLIC ACIDOSIS AND DEATH.

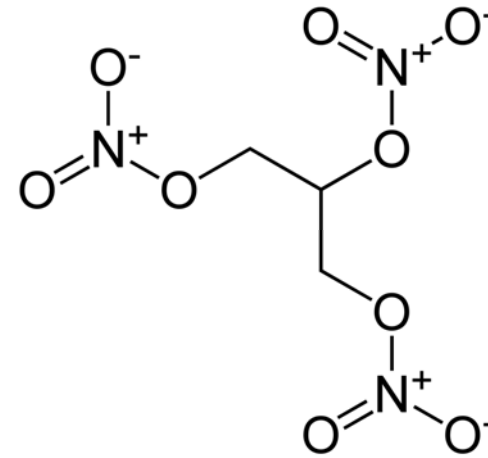
## PREVENTION OF CYANIDE POISONING:

- ❧ HYDROXY COBALAMINE ABSORBS FREE CYANIDE RADICALS FROM NONTOXIC CYANACOBALAMINE AND EXCRETED.
- ❧ SODIUM THIO SULPHATE SHOULD BE INJECTED INTRAVENOUSLY IN 300 mg UPTO A TOTAL DOSE OF 150mg/KG.IT SUPPLIES PLENTIFUL OF SULPH HYDRYL RADICALS TO FORM THIOSULPHATE FROM CYANIDE RADICALS.
- ❧ IN ACUTE CYANIDE POISONING METHYLENE BLUE,NITRATES OF SODIUM THIO SULPHATE ARE ANTIDOTES.
- ❧ MORE RECENTLY COBALT ACETATE IS GIVEN 300 mg INCREMENTS INJECTED SLOWLY.METABOLIC ACIDOSIS SHOULD BE TRATED SIMULTANEOUSLY WITH SODIUM BICARBONATE.

❧ PATIENTS WITH VITB12 DEFECIENCY, LEBER'S OPTIC ATROPHY AND TOBACCO AMBLYOPIA SHOULD NOT BE GIVEN SNP.

❧ CHRONIC ADMINISTRATION OF SNP TO HYPERTENSIVE PATIENTS CAN CAUSE HYPOTHYROIDISM DUE TO PROLONGED ELEVATION OF SERUM THIOCYANIDE LEVEL.

## GLYCERY TRI NITRATE:



MOA: RELEASES NO WHICH CAUSES VASODILATION.

USUAL DOSE: 0.5 – 2 mcg/KG/min.

EFFECT SEEN USUALLY WITH IN 3-5 MINUTES.

HALF LIFE OF NEARLY 3-4 MINUTES.



## PROPOFOL:

- ❧ PHENOLIC COMPOUND.
- ❧ CAUSES MYOCARDIAL DEPRESSION AND VASODILATATION.
- ❧ USUAL DOSE: LOADING DOSE OF 1-2.5mg/KG FOLLOWED BY A MAINTENANCE DOSE OF 50-200 mcg/KG/min OR INTERMITTENT BOLUSES.
- ❧ EFFECTS SEEN ALMOST IMMEDIATELY.
- ❧ HALF LIFE OF NEARLY 8-10 MIN AND CONTEXT SENSITIVE HALF LIFE OF NEARLY 40 MINUTES WITH CONTINUOUS INFUSION.

THOROUGH PREOPERATIVE EVALUATION OF THE PATIENT, GOOD PREPARATION AND CHOOSING APPROPRIATE TECHNIQUE AND AGENT FOR INDUCING CONTROLLED HYPOTENSION, VIGILANT MONITORING OF THE PATIENT RESULTS IN SAFE CONDUCT OF ANESTHESIA AND SURGERY AND BETTER PATIENT OUTCOME.

**CONCLUSION**

**THANK YOU**