**TURP SYNDROME - Present scenario in Normal Saline era**

**Dr. J. Revathy., Prof. & HOD., Dept. Of anaesthesiology., Chengalpattu Medical College.**

Transurethral resection of prostate (TURP) and open prostatectomy are the traditional treatments for men with symptomatic benign prostatic hyperplasia (BPH).But TURP is the gold standard in the management of BPH.

The primary concern associated with TURP is intravascular absorption of large volume of irrigating fluid during the procedure **(1)** leading to iso-osmolar hyponatraemia. The clinical manifestations brought about by this is referred to as TURP syndrome. Over the last 10-15years, TURP has undergone significant technical improvement with a concomitant reduction in morbidity and mortality.

 Traditionally TURP is undertaken using monopolar diathermy. Bipolar TURP technology is now available with significant advantages over monopolar technology. It was introduced in 2002 where resection is done with saline and this was a welcome change and dawn of a new era as it eliminated the complication of TURP syndrome.

**Ideal irrigation fluid**: The type of irrigation fluid used has a bearing on the pathophysiological events. No such thing exists of course, but these are desirable.

 Transparent (for good visibility)

 Electrically non-conductive (to prevent dispersion of current)

 Isotonic

 Non-toxic

 Non hemolytic when absorbed

 Easy to sterilize

 Inexpensive

A multitude of irrigation solutions have been evaluated for TURP but all have their limitations.

Commonly used irrigating fluids for TURP

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| Solution | Osmolality (m.osm/lit) | Advantages | Disadvantages |
| Distilled Water | 0 | Improved visibility | HaemolysisHaemoglobinaemiaHaemoglobinuriaHyponatraemia |
| Glycine 1.5% | 200 | Less likelihood of TURP syndrome | Transient Postoperative visual syndromeHyperammonaemiaHyperoxaluria |
| Sorbitol 3.3% | 165 | Same as Glycine | HyperglycaemiaLactic acidosisOsmotic Diuresis |
| Mannitol 5% | 275 | Isoosmoar solutionNot metabolized | Osmotic DiuresisAcute intravascular volume expansion |

Adapted from Krongrad A, Droller MJ: Mosby Year Book.

SORBITOL

 A nontoxic isomer of mannitol (3.5%) is rapidly metabolized to 70% co2 and 30% dextrose .A small portion is excreted by kidneys. Sorbitol at this concentration is hemolytic.

MANNITOL

 5% is iso-osmolar, not metabolized and excreted by kidneys. If large amounts are absorbed it can produce intravascular volume expansion and cardiac decompensation.

CYTAL

 3% solution of cytal and mannitol combines the best qualities of both and reduces the potential for vascular overload.

DISTILLED WATER

 Totally transparent and electrically inert and hence was used in the past. However because of its extreme hypertonicity can cause haemolysis, shock and renal failure when absorbed.

GLYCINE

GLYCINE 1.5% in water is the commonly used as irrigation fluid for TURP. Because it is hypo-osmolar at 220mmol/lit, non-conductive, non haemolytic and has a neutral visual density. It is a non essential amino acid, normally metabolized by oxidative transformation into ammonia**(2)**.Depressed mental status and coma lasting for 24-48 hrs postoperatively is related to hyperammonaemia.It has been reported following TURP procedure using glycine presumably from glycine metabolism**(3)**. Glycine also has cardio depressant effects and may have renal toxicity. Visual disturbances are due to brainstem or cranial nerve inhibition**(4)**. Physical findings included sluggish non-reactive pupils suggesting a neurological pathway disturbance rather than cerebral oedema**(5)**.An inhibitory retinal action of glycine could be responsible for blindness since it has structural similarity to aminobutyric acid, an inhibitory spinal cord and retinal neurotransmitter. It can cause encephalopathy and seizures by potentiating the effects of N-methyl-D-aspartic acid (NMDA) neurotransmitter and hypomagnesaemia which is caused by dilution.

Hyponatremia (dilutional or natriuresis)

 Iso or mildly hypo-osmolar

 Increased osmolar gap from absorbed glycine

 Hyperglycinaemia (upto 20mmol----normal is 0.15 to 0.3mmol/Lt)

 Hyperserinaemia (major metabolite of glycine)

 Hyperammonaemia (major metabolite of serine)

 Hyperoxalaemia and hypocalcaemia (glycine is metabolized to glycoxylic acid and oxalic acid, the latter forms calcium oxalate crystals in urinary tract and may contribute to renal faiurel.

 Metabolic acidosis and haemodilution.

 It can cause encephalopathy and seizures by potentiating the effects of N-methyl-D-aspartic acid (NMDA) neurotransmitter and hypomagnesaemia caused by dilution may increase the susceptibility to seizures.

Methods of absorption of irrigation fluid

 Fluid enters the blood stream directly through open periprostatic sinuses and accumulates in the periprostatic and retroperitoneal spaces. The latter occurs primarily if prostatic capsule is violated during surgery. The average rate of absorption is 20/ml to 200ml/min**(6)**.

Factors that increase risk of TURP Syndrome**(6)**

 \_Preexisting pulmonary oedema or hyponatraemia

 \_Prostate size larger than 60-100gms

 \_Inexperienced or slow surgeon

 \_Procedures longer than 1 hr

 \_Hydrostatic pressure greater than 60cm of water

 \_Reduced venous pressure (dehydration)

 \_Use of large volumes of hypotonic intravascular fluid.

It also depends on the aggressiveness of the surgeon with the electrocuting loop, pathology of the gland, amount of gland removed and extensively distended bladder.

Early symptoms associated with TURP Syndrome are mostly related to acute intravascular fluid expansion independent of changes to serum osmolality and sodium**(2)**.

Estimation of volume of irrigation solution absorbed

 Volume absorbed = Preoperative [Na+] x ECF\_\_ - ECF

 Postoperative [Na+]

ECF is calculated as 20% of body weight.

ECF (lit) = 0.2 x Body wt (kg)

Other methods of estimation are:

 \_Breath alcohol level (ethanol used as tracer in irrigation fluid)

 \_CVP trend

 \_Plasma electrolyte concentration (magnesium and calcium)

 \_Trans-membrane impedance change

 \_Weight gain

Initial hypertension and bradycardia from acute volume overload may evolve into left heart failure, pulmonary oedema and cardiovascular collapse**(7)**.

With continued absorption of hypotonic irrigation fluid, cerebral oedema may develope as a consequence of dilutional hyponatraemia. Rapid change as opposed to a specific low threshold serum sodium concentration is responsible for TURP syndrome**(8)**

 Signs & symptoms of acute hyponatraemia

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| Sr. Sodium (M.Eq/Lit) | CNS Changes | ECG Changes |
| 120 | ConfusionRestlessness | Widening of QRS complexes |
| 115 | SomnolenceNausea | Widened QRS complexesElevated ST segment |
| 110 | SeizuresComa | Ventricular Tachycardia or Fibrillation |

Adapted from Jensen V: Can.J.Anaesth.

Mechanisms causing hyponatraemia

1. Dilution of serum sodium due to excessive absorption of irrigation fluid
2. Loss of sodium into irrigation fluid from resection site
3. Loss of sodium into irrigation fluid accumulated in periprostatic and retroprostatic spaces.

 One of the greatest advantages of bipolar TURP is that it is performed with saline irrigation. Without the use of glycine as irrigation fluid, the risk of TURP syndrome is eliminated. Although are complication of unipolar resection is(1.4%), TURP syndrome is potentially a source of considerable morbidity and even mortality **(9)**. Hyponatremia following bipolar TURP is significantly less. **(10,11)**.

 One of the most significant recent advances in TURP is the incorporation of bipolar technology. It allows TURP to be performed in normal saline environment, which addresses a fundamental concern of conventional monopolar TURP (i.e. The use of hypo osmolar irrigation) As a result the risk of dilutional hyponatraemia and TURP syndrome are eliminated**(12)**. Normal saline does not cause harm when absorbed, hence the type of irrigation fluid used has a bearing on the pathophysiological events.

Bipolar technology requires a high frequency energy generator (electro surgical unit-ESU) to produce energy. HF energy then passes through saline irrigation medium in the gap between the two electrodes of the bipolar loop. High temperatures around the loop create a plasma or light arc, which facilitates cutting through the tissues **(13)**. Initially bipolar technology was used to perform transurethral vaporization of prostate (TUVP) **(14)**. Effective coagulation, improved visibility and reduced bleeding led to day case delivery of this technology in many centres **(15)**. Presently there is a renaissance with the introduction of Olympus transurethral resection in saline (TURIS) vaporization device. With technological advances, the bipolar electro surgery evolved from TUVP and currently there are five different types of devices available namely Gyrus ACMI, Vista coblation, Olympus TURIS, Karl Storz and Wolf **(16)**.

Normal saline is used for irrigation with bipolar resection **(17)** because it is the nearly iso-osmolar irrigate used and it eliminates the possibility of TUR syndrome. Saline conducts electric current, so it is used for bipolar TURP and the current passes through the saline medium between the lobes before returning to the generator. Results demonstrate bipolar TUR in saline caused less drop in Haemoglobin and sodium levels and less fluid overload than the conventional monopolar TURP**(18)**.

The plasma effect created by bipolar resection loops cause a “Cut and Seal" effect which significantly reduces bleeding and improves visibility when compared to conventional mono polar TURP” as the site where the surgical effect is required is under direct vision of the user at all times. In a study by Patankar et al., the mean blood loss per 50 cc of prostate resected was 140.6 ml for bipolar TURP compared to 282.6 ml for mono polar TURP**(19)**.

Bi polar diathermy is precise and safe as the path of current flows only through the volume of tissue between the poles of each electrode. The risk of electrode burns, alternative current pathway burns and interference with pace makers or other electrical implants is therefore eliminated. It also reduces the risk of obturator nerve excitation and “Obturator Kick”**(20)**.

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| Advantages of Bi-polar TURP using Normal saline |
| 1 | No TURP syndrome |
| 2 | Resection time need not be limited to one hour |
| 3 | Improved training opportunity |
| 4 | No Diathermy pad required |
| 5 | No Obturator or Cardiac device stimulation |
| 6 | Decreased bleeding and clot retention |
| 7 | Decreased chance of blood transfusion |
| 8 | Improved visibility |
| 9 | Very large prostates (> than 100 gm) can be resected quite safely |

In a randomized comparison between three types of irrigation fluids (Glycine, Glucose and Saline) during resection it was concluded that 5% glucose and 0.9% saline where associated with lower incidences of TURP with no cardiac toxicity **(21)**.

 Few studies have been published comparing the monopolar and bipolar TURP. All the studies showed reduced blood loss and sodium loss with bipolar TURP.

 Study by Starkman**(22)** showed that the complication with Bipolar TURP was less. The hospital stay and catheterization duration was also less with bipolar TURP. Bansali et al evaluated the utility of the bipolar TURP in patients with large prostates and concluded that the bipolar TURP was safer in large prostates.

**NEWER SURGICAL TECHNIQUES**

Some of the minimally invasive methods for treatment of TURP

1. TUERP—Transurethral enucleation and resection of the prostate. Too deep resections in certain areas may cause capsular perforation.This technique obviates this complication by retrograde enucleation and resection.
2. TUNA—Transurethral radiofrequency needle ablation of prostatic tissue using low level monopolar radiofrequencies. It is a short stay outpatient procedure, suitable for high risk patients.
3. TUMT-- Transurethral microwave thermotherapy uses radiant heat to ablate prostate tissue. Advantage is similar to TUNA.
4. TULIP—transurethral ultrasound guided laser induced prostatectomy can produce coagulation necrosis, vaporization, or resection.HoLap (holmium laser ablation of prostate) is safer for patients on anticoagulants or bleeding disorders, done as outpatient procedure. Green light laser photovaporisation of prostate (GLL-PVP) Uses KTP. The rapid absorption of green light causes tissue vaporization.
5. Ethanol ablation, prostatic stents are useful for individuals with co-morbidities.
6. LAPROSCOPIC MILLINS PROSTATECTOMY-In the hands of experienced team it is safe, with minimal haemorrhage and postoperative complication.
7. GENE THERAPY-Using herpes simplex virus to selectively ablate PSA secreting cells.

**MEDICAL MANAGEMENT**---includes

Phosphodiestrase inhibitors

Botulinum toxin

Vitamin D3 analogues

LHRH Antagonists and Progestogens

Hydroxitamoxifen.

In future, urologists will prefer to use bipolar diathermy over Mono polar resection for the above said advantages like clarity of vision, non-restriction of resection time and good training opportunities.

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