

## GS 5% 0.9% viz Isotonic Saline 0.9% in Head Injury Management

Abbas A Shakir Alnaji\*

Department of Neurosurgery, Al-sadder Teaching Medical City, Najaf, Iraq

### Abstract

Very few measures actually can help the head injured patient. One of them is, the quality of intravenous fluid IVF. Glucose-saline (or dextrose-saline) of 5% and 0.9% (hyperosmolar 560 mOsm/L) in comparison with isotonic saline 0.9% (or physiologic saline osmolality near 300 mOsm/L).

**Method:** Over 10 years of personal experience, we supply as a maintenance head injured patients (GCS below 12) with different types of intravenous fluids with close observation to the clinical outcome for the same groups of severity of injury, age and gender.

**Results:** Subjectively the ascent in GCS score is noticeable in all groups received glucose saline 5%, 0.9% compared to those supplied with isotonic saline 0.9%. While those who received glucose saline of isotonic strength with its different formulations had more prolonged recovery.

**Conclusion:** this good effect is due to hyperosmolality which augment blood osmolality in face of disrupted blood brain barrier BBB Pharmacodynamically, it means it will not worsen brain edema if not improve it. Additionally, it also may be due to Insulin anabolic effect triggered by this extra glucose.

**Keywords:** Normal Saline; Glucose Saline; Dextrose Saline; Head Injury Management; GCS Better Outcome; IVF In Head Injury; Anabolism In Head Injury; Insulin In Head Injury; Growth Hormone In Head Injury; Anabolic Hormones In Head Injury

### Introduction

Really few done of actual benefit for the head injured patient whatever its severity. Like, head elevation, normalization of blood gases, and correct fluid intake both in quantity and quality. Through my experience which lasts for not less than 20 years from residency in neurosurgery until consultancy, I found what ever done as sophisticated measures or drugs given to treat brain edema without applying those simple three criteria is of no or bad effect, like hyperventilation, mannitol, anti-glutamate and many others which are well known for all neurosurgeons.

### Materials and Methods

Through my personal career in clinical neurosurgery over 2 decades, and through my idea to use hyper tonic solution

other than mannitol, this Glucose 5% saline 0.9 (GS 5 0.9) was emerged to existence. So I started to apply it where we were use isotonic saline and other formula of glucose saline (0.18% NaCl+4% glucose, 0.45% NaCl+ 5% glucose).

In short the patients in this study are both genders of all age groups and GCS is < 12. The maintenance IVF is (glucose saline 5% 0.9%) was given in two regimens; First, as a usual daily requirements 30 -50 ml / kg / day (the range is decided by the patient body temperature and the surrounding temperature). Second, 15 -20 ml /kg/day + volume of urine output of the previous day. Severely injured patients treated in ICU while milder ones in hospital wards. Patients randomly put in groups of severity, age and gender e.g. boys patients of age below 5years years of GCS below 7 and so on with adding newly patients with time. Follow up after recovery also put in consideration.

**\*Corresponding author:** Abbas A. Shakir Alnaji, Department of Neurosurgery, Al-sadder Teaching Medical City, Najaf, Iraq, Tel: 009647806823625; E-mail: [abbasalnaji@yahoo.com](mailto:abbasalnaji@yahoo.com)

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## Results

Subjectively, the patients given GS 5 0.9 improved more rapidly than those supplied with isotonic saline 0.9 % NaCl this improvement is noticeable. While those patients supplied with other glucose saline of other strengths like GS 45 18 are of very bad out come in comparison to isotonic saline where the period of recovery is longer. As for follow up the post recovery symptoms of head ache, vertigo, memory regaining, personality changes are less severe in same sequence (GS 5 0.9 better than NS 0.9 and this better than other GS formulas, Ringer solution not in use in this study).

If we ask for some specificity in this study, we saw the pediatric age group of both genders are more recoverable than others with GS 5 0.9.

## Discussion

Intravenous fluid IVF for head injured patient is not for replacement of a deficit. The patient usually when subjected to the injuring accident is well hydrated or euhydrated. The classical teachings direct the attention to make blood or plasma relatively hyperosmolar which is well known strategy since the era of Urea and now with mannitol.

Let us review the idea behind dehydration through a dehydrating agent to make the role of glucose saline 5% 0.9% GS5/0.9 is clearer.

As urea gone a way we will speak on the current dehydrating agent which is mannitol (20 % osmolarity 600 mosm/L). This inert sugar when administered into intravascular compartment renders the plasma or blood hyperosmolar relatively to interstitial IS and intracellular IC spaces so water withdrawn accordingly. Making these interstitial and intracellular somewhat less edematous. In this, pure water is withdrawn from all body spaces (IS and IC spaces) and thrown outside the body as a urine with a lot of important salts the body is in deadly need to preserve and regulate them to regain its homeostasis.

If we come to glucose saline 5% 0.9% (GS 5% 0.9% osmolarity 560 mOsm/L) the following will happen after administration to the head injured patient. As this GS 5 0.9 passes through vascular tree and reaches the capillary bed of injured brain its hyperosmolarity will act as dehydrating agent to force pure water out of the IS and IC spaces including the capillary edematous endothelium, this phase can be termed as a FIRST PASS EFFECT FPE. Then when this GS 5 0.9 become within the whole blood pool the glucose part will stimulates insulin secretion by the usual physiologic manner to enter it into the cells. What will be left is an isotonic saline in this blood pool which is not harmful. Physiologically it is a continuous process of FPE and changing from hypertonic GS 5 0.9 to isotonic saline as long as the pancreatic function is normal.

We want to say, this FPE and the role of stimulated insulin are of benefits to the head injured patient over isotonic saline NaCl 0.9%.

www.trauma.org is recommending the isotonic saline (0.9 % NaCl) in treatment of head injury [1]. So I left my policy of use of GS 5% 0.9% again to re-check the previous effects I obtained through the use of isotonic saline, the results where the same as before; GS 5 0.9 is superior to isotonic saline for patients faster recovery.

It is difficult to plot a graph for such results because it is a subjective vision and so the application and results observation.

Also it is a trial to explain the beneficial effect of this regimen through introducing the physiological aspect of insulin secretion triggered by this added glucose on isotonic saline and its anabolic and positive effect in improving the patients in comparison to isotonic saline alone [2-11]. Because glucose is readily enter the cells and disappears from circulation under the role of insulin, so the logic analysis is the excess of insulin seen with GS 5 0.9 but never seen with isotonic saline (lab confirmation is needed with insulin plasma level in both cases of GS 5 0.9 and isotonic saline 0.9). Of course the insulin cannot be said it works separately from other hormonal cascade initiated by insulin itself, like growth hormone and other anabolic hormones where they together act to aid or repair sub-cellular (cellular ultra-structural impairments) defects whether primary or secondary.

Isotonic saline is considered isotonic when the is normal blood brain barrier BBB, but when BBB is disrupted and tight junctions open as gaps the isotonic saline becomes hypotonic because these inter-cellular gaps when open large, makes the complex of Sodium atom (molecule of NaCl after splitting in the solution) which is surrounded with 4 or 5 water molecules can pass this gaps to settle in the Interstitial compartment, in a time this Na-water complex were unable to pass sound BBB, by this we brought more volume to IS space and as a result more pressure and so swelling and more ischemia [12]. While when we add more solutes to the Na-water complex as glucose molecule it seems little will pass these opened brain endothelial gaps which we termed previously first pass effect FPE, for that less IS edema. So the tonicity of solution is relative to the tissue in question. So different conditions of the tissue necessitates its own environments in that the isotonic becomes hyper- or hypotonic to that given tissue condition.

While the use of other glucose saline formulas like 0.18% NaCl+4% glucose (also called 1/5<sup>th</sup> saline) and 0.45% NaCl+5% glucose (without Potassium) is of worse effect not only by the practice as patients become delayed in their recovery and post recovery according to what is mentioned above, but also to the physiologic analysis where glucose will pass into the cells and what will stay in blood stream is the 0.18% NaCl and the 0.45% NaCl which both of them are hypo-osmolar acting to dilute blood and hence more brain edema ( even in presence of FPE theory or

insulin anabolic or positive effect on brain theory). While in case of GS 5% 0.9% when glucose leaves the blood 0.9% NaCl will stay and it is isotonic without dilution effect to the blood.

I did not find in literatures reviewed by me any notice to the way or explanations of this glucose saline 5% 0.9% use in head injured patients.

### Conclusion and Recommendation

The administration of glucose saline 5% 0.9% (one liter contains glucose 5% + NaCl 0.9 %, osmolarity 560 mOs/L) to the head injured patients of any severity, all age groups and both genders is of noticeably more encouraging GCS better out come to isotonic saline ( Na Cl 0.9%).

I recommend use of glucose (dextrose) 5% + NaCl 0.9 in all head injured patients that needs maintenance intravenous fluid.

And to cooperate with interesting centers to more organize the methodology and lab study of what is mentioned as hypothetical analysis to the results.

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