Methods & Materials

METHODS AND MATERIALS

The management of patients in critical conditions always had been a matter of challenge to the clinicians as, in a short span of "crisis period" patients needs to be stabilised. Study was conducted with patients enrolled from the selected multispecialty hospitals of Ahmedabad, Gujarat, each with an average capacity of 200 beds. These hospitals had intensive care units well-equipped medical/surgical department including biochemistry / pathology / microbiology / radiology as well as a dietary department for carrying immediate necessary diagnostic procedures for imparting medical and appropriate nutrition support to handle patients in critical conditions. Between the study period 2003 – 2006 all the patients within the age of 17 – 65 years were randomly selected from the selected hospitals and enrolled into the study. The study was carried in three phases [*Experimental Flow Chart,* Fig 6]. In all hospitals ethical clearance was obtained before starting the study.

SECTION I :

In order to collect first hand information on the number and the types of critically ill gastrointestinal patients admitted in the Intensive Care Units (ICUs), a survey (Section I) was made in the three leading hospitals of Ahmedabad city, Gujarat. For the ethical reasons, the names of the hospitals are not disclosed but are represented as A, B, and C. The retrospective records of the patients admitted in the ICUs' of these three hospitals were made use of for the period prior to August, 2002. Thereafter, a weekly admission record of the ICU patients in each hospital was noted. Under the circumstances, the desired information could be gathered for 303 days, 314 days and 372 days from A, B and C hospitals, respectively.

The information collected on the admitted patients of the hospitals included patients registration number, name, age, sex, diagnosis of the ailments, date of admission and date of release or expire. In this report, the name and the registration number of the patients have not been incorporated due to ethical reasons. It may be noted that the

number of patients in any hospital, during the period of observation do not reflect the total number of patients of all intensive care unit (ICU)'s of the concerned hospitals but only the critically ill patients permitted to consult by the hospital as well as on the accessibility into the ICU records made available by the hospital administration. Information collected on the critically ill patients may not be treated as absolute total patients of all ICUs' of those hospitals and therefore, are not exhaustive. The data collected were then classified into various groups for the convenience of interpretation.

Section II:

Based on overview of results of the survey carried out in phase I, the gastrointestinal disease profile in different hospitals were taken into account and supplementation as per predetermined protocol was decided. Supplementations with two kitchen-based polymeric enteral diets are carried out in Phase II. Subjects both male and female undergoing gastrointestinal surgical procedures, aged between 17 - 65 years, who required adjuvant nutritional support were randomly selected and entered into the study. They were randomly allocated to receive the routine hospital diet (*EnR,* group 1) and enteral nutrition enriched with protein sources either from soy (*EnS,* group 2) or milk (*EnM,*. group 3). Exclusion criteria were of the following – Insulin dependent diabetes mellitus (IDDM), renal disease, cardiac (type I and II) and pregnancy.

1.Patients Groups:

As per the eligibility criteria gastrointestinal patients undergoing surgical procedures and requiring adjuvant nutritional support were entered into the study. Proper diagnosis of ailments was made and appropriate medical interventions were administered. Nutrition support was administered as per the predetermined protocol [Appendix 1].

(a) General Information:

The name, gender, in-patient number including date of admission, date of surgery and date of discharge from the hospital were recorded for each of the patients.

(b) Diagnosis:

On admission in the hospital, disease diagnosis was made based on clinical and biochemical assessment. The consultant physician or surgeon looking after the patient suggested necessary interventions.

2.Nutritional and Physiologic Status:

At study entry body mass index (BMI) was calculated. The most convenient way to determine whether a person is at his/her ideal body weight is to use the Body Mass Index. BMI describes body weight relative to height. BMI values apply to both men and women and serve as a means for comparing adult persons in terms of underweight, normal weight, overweight and obesity.

Body mass Index (BMI) was calculated as per the formula, Weight (Kg) / height^2 (cm) or it can also be calculated as BMI = 703 * weight (pound) / height * height (inch^2) depending on the units preferred.

BMI Classification [according to ACCM 2000, NIH 1998, WHO 1998]

BMI	Interpretation
≤ 18.5	Underweight
18.5 - 24.9	Normal weight
25 - 29.9	Overweight
≥ 30.5	Obesity

In addition, serum albumin was recorded and Nutritional Risk Index (NRI) was calculated as per the equation:

(1.519 × serum albumin) + (0.417 × % usual body weight)

According to this calculation, subjects were categorised as 'severely-malnourished'(Sm) (NRI < 83.5), 'mild-moderately malnourished' (Mm) (NRI 83.5 - 98.5) and 'well-nourished' (Wn) (NRI > 98.5). These sub-groups were taken into consideration for interpretation of results. [*Schneider and Hebuterne 2000*]

3.Nutritional Support:

The mode of nutritional support was provided under the supervision of consultant clinician/surgeon looking after the patient that he or she considered being appropriate. This decision was based on a clinical assessment of intestinal function, which in all cases included inquiry as to bowel habit and passage of flatus together with clinical examination. Pre-operative nutrition was based on the degree of illness, clinical assessment of the intestinal function as deemed by the clinician either oral / enteral but not oral feeding.

4.Feeding Methods:

Post-operative nutrition was delivered through central venous access (in few cases) till the patients restored to enteral nutrition. The postoperative diet administration was phased out as — Duration of Total Parenteral Nutrition (TPN) and Duration of Enteral Nutriton (EN)

The post-operative TPN nutrition was supported by means of central line delivery method till the patients were ready to be fed on enteral nutrition route. Patients receiving TPN received continuous infusion over 24 - hours as *all – in - one* TPN formula through central venous access in addition to 5 % DNS and 25 % dextrose.

As per tolerance patients were slowly shifted to enteral nutrition (EN) with polymeric enteral feeds as per the protocol. The standard method of delivery was either nasogastric (NG) /nasojejunal (NJ) feeding tube and in few cases feeding jejunostomy (FJ) wherever appropriate, as decided by the clinician.

The daily intake of diet right from the day of admission up to the end of enteral nutrition of each of the patients was recorded. The diet intake in terms of macronutrients (energy, carbohydrate, fat and protein) was assessed for each of the patients. The intake was, however, not recorded as soon as the patients were restored to oral diet.

5. Enteral Diet Administration:

Calorie needs was calculated using Harris-benedict equation [Harris and Benedict 1919]. The actual requirement of energy of each of the patient was calculated by using Harris- Benedict (1998) Basal Energy equation (BEE) which were as follows:

a) Men : BEE = [66.5 +13.6 (W) +5 (H) – 6.8 (A)]

b) Women : BEE = [655 + 9.6 (W) + 1.7 (H) – 4.7 (A)]

Where: W = Weight in Kg ; H = Height in cms ; A = Age in years.Total Energy Expenditure (TEE) was estimated along with it by using activity (AF) and stress (SF) factors. From the values such obtained, the requirement levels of carbohydrate, protein and fat were calculated for each patient.

Feeds were delivered post-operatively through gravity bag with gradual increase in frequency and volume till the target calories were achieved according to patient

tolerance. During this build up period, tubes were aspirated before every feed. Daily intake record [*Gopalan 1993*] and complications in terms of feed tolerance were monitored.

6. Diet Composition:

Control diet consisted of routine hospital diet (*EnR*). Kitchen-based polymeric diets consisted mixture of cereal-with protein sources either from soy (*EnS*) or milk (*EnM*). Fat source was from coconut oil rich in medium chain triglycerides (MCT). Diets were cooked in clear vegetable soup. Each diet supplied on an average 1000 kcal L^{-1} with 21% protein and 30% fat with 58% carbohydrate. Diets were also calculated for osmolality and renal solute load. Composition of the formulas has been given below:

Composition Of Polymeric Kitchen based protein rich Enteral diets :

1.Soya enriched kitchen-based polymeric enteral diet (*EnS*):

Carbohydrate: 58 % [147.00 g] (cornstarch)

Protein: 21% [54 g] (soybean flour)

Fat: 33% [40 g] (MCT oil)

Fibre: 6.5 g L^{-1}

Calorie Density : 1.01 Kcal ml^{-1} Calorie: Nitrogen =116.6:1
Osmolality: 309.92 Osm L^{-1} (45 g 250ml^{-1}) Renal solute load (RSL): 422.5mOsm

2. Milk enriched kitchen-based polymeric enteral diet (*EnM*):

Carbohydrate: 58.6 % [150.00 g] (cornstarch)

Protein: 21 % [54 g] (skimmed milk powder)

Fat: 33 % [40 g] (MCT oil)

Fibre: 1.70 g L^{-1}

Calorie Density: 1.01Kcal ml^{-1} Calorie: Nitrogen = 116.6:1
Osmolality: 327.31Osm L^{-1} (47g 250ml^{-1}) Renal solute load (RSL): 451.16mOsm

7. Outcome Measures:

Duration of feeding and feeding related complications (large volume aspirates, tube occlusion, vomiting, abdominal bloating, diarrhoea) in both TPN and EN stages were recorded. The average daily intake at each stage of pre-operative stage and post-operative nutrition stage were recorded and compared with the actual requirement.

The impact of diets on hemogram (hemoglobin, complete blood count), biochemical parameters (total protein, albumin, globulin, creatinine, urea), electrolytes (sodium, potassium, chlorine), liver function tests (total bilirubin, ALT, AST, alkaline-phosphatase) were recorded wherever feasible by collecting blood samples on entry into the study during in each stage of post-operative TPN and EN nutrition. Feeding tolerance, weight loss/gain along with length of hospital stay were also included as outcome measures.

Statistical Analysis:

The data collected were classified and appropriate statistical methods were applied. All parametric data were expressed as mean and standard deviation. The actual range of data has also been mentioned wherever applicable. Comparison between the groups were made using *Student's t* test for quantitative data and *Mann Whitney U test Kruskal-Wallis* or *H* test for qualitative data to know the level of significance of the diets and at different stages of post-operative nutrition and the values with appropriate level of significance have been mentioned A ***p*** value of 0.05, 0.01 and 0.001 or less was taken to signify a statistical significant difference [Gupta 1991]. Values have been mentioned with symbols [$^{*\ \#\ @\ \Psi}$] to denote the level of significance.

Section III:

This phase of the study includes surgical gastrointestinal patients randomly selected as per predetermined protocol for a period of 1 year. Exclusion criteria included subjects with IDDM, renal disease, cardiac and pregnancy. They were allocated to receive enteral diet enriched with protein sources either from soy (*GEnS,* group 5) or milk (*GEnM,* group 6) and compared with their control receiving routine hospital diet (*GEnR* group 4) *with substrate enriched for each groups with enteral pure L-glutamine.* Enteral glutamine was administered at a rate of 0.3 g kg^{-1} body weight divided in doses

[*Hond et.al., 1999*]. In every case tolerance based on clinical symptoms were monitored. Supplementation was carried on an average of 12 -14 days.

Methodology for assessment of nutritional status on study entry, feeding methods, enteral diet administration including outcome measure procedure along with statistical analysis was as per mentioned in Section II [Appendix 1]. The impact of glutamine supplementation was assessed based on clinical assessment and overall improvement in biochemical parameters including weight loss or gain and length of hospital stay (LOS).

Fig 5: POLYMERIC KITCHEN – BASED PROTEIN RICH EN WITH SOURCES FROM SOY (Formula I) AND MILK (Formula II)

Fig 6: POLYMERIC KITCHEN – BASED PROTEIN RICH EN WITH SOURCES FROM SOY (Formula I) AND MILK (Formula II) & SUBSEQUENT SUBSTRATE ENRICHMENT WITH GLUTAMINE

Fig 6: EXPERIMENTAL FLOW CHART