Use Of Software Assisted Monitoring And Prescription Of Feeds In Improving The Delivery Of Nutrition In A Tertiary Care ICU.

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ABSTRACT

Background: Iatrogenic underfeeding has been one of the biggest problems that all intensive care units face in spite of the formation of clinical nutrition support teams.

Methods: We decided to study whether a home grown nutrition based software in addition to the existing practices could be used in the planning, monitoring and decision making process and thus help in reducing the incidence of iatrogenic underfeeding. Calorie and protein deficits were thus analysed in two time spans, before and after the introduction of the software.

Results: The results of the study indicated that computer assisted delivery of nutrition helps in reducing underfeeding in the ICU.
INTRODUCTION:
Patients that are not able to swallow or take food or medications by mouth e.g., patients on ventilator support, critical illness, trauma, sedated, or with dysphagia after stroke, typically receive nutrition intravenously through a catheter, which is referred to as parenteral nutrition, or through a feeding tube, which is referred to as enteral nutrition. Enteral feeding is typically used to feed patients when there is no contraindication of the gastrointestinal tract. In critical care areas especially in India enteral feeding seems to have an advantage over parenteral nutrition due to cost, prevention of infection etc. and hence is the preferred method of feeding. While the administration of enteral or parenteral nutrition is effective and beneficial for patients, the effectiveness would also depend on proper ordering, administration, and monitoring of the feeding. The administration of enteral or parenteral nutrition is a multidisciplinary process that can be hindered due to breaks in communication, complexities of modern healthcare, and decreased staff, both at the bedside and at the nutritional support level. Despite the attention given by healthcare professionals (HCPs) to the management and practice of providing adequate nutrition to patients, the patients may be undernourished. To make matters worse, malnutrition in hospitals and specialty centres is a serious concern since many HCPs (Health Care Professionals) are not oriented towards the importance of Nutrition therapy as they are towards Drug therapy. Physicians & Dieticians in the hospital/clinic environment desire the convenience of an error-proof, quick and innovative approach in planning the diet charts of their patients, which normally takes 30-40 minutes per patient depending on the complexities. Modern hospitals today typically have more than 100 patients daily who require some specialized form of nutrition that may warrant proper planning and calculations. This makes it difficult for a physician/dietician to create comprehensive customized diet charts for every patient and also to monitor their compliance on a daily basis. Historically, it is a known fact that there is a direct correlation between malnutrition and adverse outcomes, which has been well documented since the 1930's. The body's natural metabolic response to illness leads to wasting of the lean body mass, which then further impairs immune function in the body. Studies have shown detrimental clinical outcomes in patients that are critically ill and are underfed and/or malnourished. These patients are at a much higher risk of infection, developing pressure ulcers, delay in wound healing, prolonged hospital stays, morbidity, mortality, and an overall increase in their cost of care. Accordingly, there is a need for a system to assist healthcare providers (HCPs) to assess, plan, monitor and maintain accurate and well-documented records of nutrition therapy and regimen, especially in the parenterally and enteral fed patient population. The author’s team felt the need for this kind of software. Over a period of two years the team developed an innovative web-based application for planning, monitoring and help during decision making in critical care nutrition in a very scientific and objective manner. iNutrimon In planning phase of nutrition helps in the calculation of severity of illness scores, risk for malnutrition. With the help of patient demographics and data regarding the illness and associated interventions like mechanical ventilator etc. the protein and caloric requirements are suggested based on predictive equations. The requirements are then computed and the scientific formulate is then prescribed by the software with the exact amount of fluid prescribed. The delivery of this formulation is then followed up real-time by inputs from the
nurses. The deficits found are then caught up in the next day feeding leading to a complete delivery of the requirements.

MATERIAL AND METHODS:
All patients who were tube feed or received parenteral nutrition in a 30 bedded adult intensive care unit were included in the study. Those patients who had volitional intake were excluded from the study.
Retrospective data of calorie and proteins prescribed and the actual delivered to 80 patients were studied by chart review during each first week of from January to June 2016. The “inutrimon” was then implemented from January 1st 2017 after a 1 month training for doctors, nurses and dietitians. The calorie and protein deficit were then studied for 93 patients in the 1st week of January to June 2017 when iNutrimon were used for planning and monitoring critical care nutrition.

Statistical Analysis.
The data was analysed using a professional statistic package EPI info version 7 for windows. Descriptive data was represented as mean +/- standard deviation for numeric variable percentage and proportion for categorical variables.

Demographic Data.

Table 1 below shows the demographic data collected for analysis which includes the sex distribution, age, height, weight and Apache score.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Before iNutrimon n = 80</th>
<th>After iNutrimon n= 93</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex distribution</td>
<td>Male – 61.2%</td>
<td>Male - 63%</td>
</tr>
<tr>
<td></td>
<td>Female – 38.8%</td>
<td>Female – 37%</td>
</tr>
<tr>
<td>Age (Mean age Years)</td>
<td>61.8</td>
<td>63.7</td>
</tr>
<tr>
<td>Height ( Mean Height in cm)</td>
<td>168.2</td>
<td>163.7</td>
</tr>
<tr>
<td>Weight in Kg</td>
<td>68.4</td>
<td>65.61</td>
</tr>
<tr>
<td>Apache Score</td>
<td>9.8</td>
<td>11.2</td>
</tr>
</tbody>
</table>

RESULTS:
The figures from 1 to 8 demonstrates the results between the provision of caloric and protein loads before and after the implantation of the “inutrimon”
Figure 1 Suggested (prescribed) and delivered protein before iNutrimon

![Figure 1](image)

Figure 2 Mean percentage protein deficit before iNutrimon

![Figure 2](image)
Figure 3 Suggested (prescribed) and provided protein after iNutrimon

Figure 4 mean percentage protein deficit after iNutrimon

Mean percentage protein deficit before iNutrimon is 41.45 and mean percentage protein deficit after iNutrimon is 11.81 Calorie deficit before and after iNutrimon
Figure 5 Suggested (prescribed) and provided calorie before iNutrimon

![Graph](image1.png)

Figure 6 Mean percentage calorie deficit before iNutrimon

![Graph](image2.png)
Mean percentage calorie deficit before iNutrimon is 34.61 and mean percentage calorie deficit after iNutrimon is 9.75. Calorie and protein deficit of patients admitted in the first week of each month in medical ICU from January to June 2016 (total patient 80) when iNutrimon were not introduced were compared with data of patients admitted in medical ICU from January to June 2017 (total patients 93) when iNutrimon app was applied for providing nutrition. Mean percentage protein
deficit before iNutrimon was 41.45 (SD = 9.68) and mean percentage protein deficit after iNutrimon was 11.81 (SD = 2.91). Mean percentage calorie deficit before iNutrimon was 34.61 (SD = 9.68) and mean percentage calorie deficit after iNutrimon was 9.75 (SD = 6.01).

**DISCUSSION:**
The aim of nutritional support has been to preserve lean body mass, reduce metabolic derangements and preserve immune functions. There is evidence to say that underfeeding may prolong ICU and hospital length of stay, may lead to increase incidence of bedsores and infections.\(^1\)\(^2\). There are also two studies that have shown improvement in mortality when the patient is fed close to the requirements.\(^3\)\(^4\) The energy load could be determined by indirect calorimetry (goal standard) or by using simple predictive equations. The protein loads are generally around 1 to 1.5 g/kg actual body weight. Hence for every patient there is a defined calorie and protein requirement which is then provided by a dietary prescription. Commensurate to other data our study also showed a very high prevalence of protein caloric underfeeding which largely was iatrogenic in nature.\(^4\) The commonest causes being visit to the CT scanners, procedures conducted on the patient and nil per os status due to surgery. Surprisingly we did not have a single patient who developed intolerance feeding.

The prevalence of iatrogenic underfeeding in Indian ICUs has not been studied much. Our study demonstrated a high prevalence of underfeeding in the ICU. This probably might be the scene in other intensive care units in the country too. Similar to our study there is some data to suggest that computer assisted prescription does seem to reduce the menace of iatrogenic underfeeding.\(^5\)\(^6\) This may be due to

1. The monitoring tool on the software that shows the protein and caloric deficit in bar chart.
2. A prompt on the software that prevents chart preparation until the earlier deficits have been addressed.
3. Visual estimate of the cumulative protein and caloric deficits that the attending doctor gets during the morning rounds that can thus be addressed.
4. Assistance provided by the software in addressing the caloric and protein needs in difficult prescriptions (for eg: low water, high protein feeds as in chronic kidney disease not on hemodialysis)
5. Ensuring no increase in viscosity or osmolarity of the feeds (in powder based nutrition specifically) as a result of computer guided software driven prescription generation which would suggest feeds based on the recommendation of the scientific feeding formula. (This increase in viscosity/osmolarity resulting in diarrhea or intolerance might occur if the right quantity of water is not added to the product.

**CONCLUSION**
Our data is probably the first Indian data to study computer assisted nutrition compared to usual care. The data clearly indicates the superiority of the said protocol in achieving the nutritional goals.

**REFERENCES**

