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Special Article

Historical Development of Parenteral and Enteral Nutrition for Critically Ill Patients in Thailand during the Past 40 Years (1970-2010), and the Beginning of SPENT and PENSA

Professor Emeritus Chomchark Chuntrasakul, MD., FACS., FICS (Hon.), FRCST.,
Doctor of Medicine, Honoris Causa, Mahidol University,
Research Professor IBC, Cambridge, England

INTRODUCTION

Total Parenteral Nutrition (TPN) begun as basic research studies on beagles that were fed nothing by mouth (NPO) and administered parenteral nutrition through the intravenous line. These studies were carried out by Professor Stanley J. Dudrick and his associates, a group of surgeons from Pennsylvania, USA. After a few weeks to a few months of intravenous feeding, they found that the beagle puppies were able to grow as well as those eating normally. Following the publication of his experiments in the Journal of the American Medical Association in 1968, Professor Dudrick became well known and respected world-wide, a potential leader of

a new medical field^{1,3}. Many surgeons in the United States followed his lead in using intravenous nutrition to care for patients with nutritional problems, such as those with entero-cutaneous fistula. After TPN was given to this group of patients, the fistula spontaneously closed at a much higher rate, from 35% up to 75%. TPN was being used in patients who could not utilize their gastrointestinal tract, or who did not get enough nutrition, or those patients who had slow wound healing².

My background and early beginnings

All these events occurred during my residency

Correspondence address: Chomchark Chuntrasakul MD, FACS, FICS (Hon), FRCST, Department of Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, Thailand; Telephone: +66 2419 7727; Email: chomchark@gmail.com

training in surgery at Albany Medical Center in Albany, New York. I followed the studies on TPN until I completed my residency training in Surgery and my Fellowship in Vascular Surgery and Fellowship in Burns (1972) and returned to Thailand. I joined the staff of the Division of Traumatology, Department of Surgery, Faculty of Medicine, Siriraj Hospital in August 1972, and was appointed Instructor in Surgery on 2 January 1973. It was apparent, during my service work, that trauma and burn patients required a large degree of nutrition support. I gained some knowledge and skills by learning and studying from books and journals on nutrition, and I participated in ASPEN or ESPEN Congresses. On one occasion I went to visit a nutrition support team at the San Francisco General Hospital in California. We used to give our burn patients early enteral feeding, particularly burn patients who were directly sent to our burn unit. We had to give fluid resuscitation at the earliest opportunity after injury, before the patient was seen by other hospital physicians.

Doctors who received training from the United Kingdom at that time, before the 1970s, used Evans' formula in the resuscitation of burn shock. Since 1952, Evans has been giving burn patients fluids containing sodium accompanied by albumin during the first 24 hours of injury. When I returned to Thailand, burn patients were still receiving albumin or Fresh Frozen Plasma during the first 24 hours of burn injury. This was what you would probably do if you did not understand and recognize the pathophysiological changes occurring in burn patients.

I did not worry much about trauma patients, because I was able to handle severe trauma quite well due to the knowledge and skills I obtained from the training in the United States, and could predict what would happen to these patients. But for burn patients I could not precisely estimate my capability because of the many sources of uncertainties and a multitude of risks could simultaneously affect the patient. I might predict that this patient would turn out so and so, and sometimes they would not. This was why I spent much time caring for burn patients.

I used to see my burn patients almost every day and on many occasions would join in the dressing changes in the morning with the nurses in the burn unit, because I wanted to see the changes in the burn wounds after applying topical antibacterial agents. You could often observe the rapid changes in burn

wound color and smell. I learnt enormously from my time spent in the care of burn patients. And I loved to carry out clinical research. Research can make your work enjoyable, and gaining more and more such knowledge and skills would make you an expert not possible otherwise. I performed many clinical research studies, though mostly incomplete.

The first intention in my mind during my training in the United States was that I wanted to go back to my country to do whatever that could benefit patients in Thailand, and to attempt to help patients struggling with their illnesses as well as to behave according to Prince Mahidol's famous address to all Thai doctors.

As for a place for the care of burn patients, I looked for a room separated from other wards. Finally I found an isolated room on the 3rd floor of the trauma building close to the trauma ward. Fortunately a few nurses from the trauma ward volunteered to help me make rounds in the burn ward. I greatly appreciated the kindness I received from the Head Nurse of the trauma ward, and especially the nurses who had volunteered to help.

Due to the shortage in medical appliances, I bought a nice clean used bathtub for burn wound dressing changes every morning, and also bought a machine for boiling water for the bath. The burn ward was able to admit two to three patients at a time. Almost no other trauma doctors paid much attention to the care of burn patients. I worked in this isolated room for almost six years, but after 1978 we moved to a new proper Burn Unit, the first in Thailand. Had we opened a proper burn unit earlier, we could have seen more burn patients admitted to Siriraj Hospital.

The Faculty of Medicine, as well as the Department of Surgery, was chronically short of money. We spent a lot of money on burn patients and most of these patients were rather poor. Imported medical materials were too expensive. This led me to innovate some necessary materials for our patients. Some of these innovations are listed below.

Innovations and some development

1) Hypertonic Saline Solution (HSS) for burn shock resuscitation in the first 24 hours. It contained 200 mEq/L of sodium, with infusion rates adjusted for adequate hourly urine output^{8,9,13,17}.

2) The amnion was used as a biologic dressing, with excellent results for superficial burn wounds. This

was the first time in Thailand that the amnion was used for medical purposes^{10,41}.

3) The 1% silver sulfadiazine cream was modified to 1% silver zinc sulfadiazine. Its results were impressive for deep burns after eschar removal, and it was a great stimulator of granulation tissues so early skin graft could be done^{19,20,21,44,45}.

4) The Siriraj Medical Tulle was devised, using multilayers of wooden fiber sheets typically used in restaurant as cold wipes for hand cleansing before eating. We encouraged a Surgical Resident, as a research project, to create a cheaper wound dressing material, which when impregnated with antibiotic ointment before sterilization, was quite cost-effective. This dressing was used for clean general surgical wounds, and for skin graft donor site dressing as well as superficial burn wounds^{19,47,50}.

5) We created a blenderized diet with high-value protein, using 8 lightly boiled eggs per one liter of blenderized diet (BD), which, given at 2 liters per day, was sufficient in an adult burn patient to raise and maintain an appropriate protein level^{21,23,32,51}.

6) A special enteral formula called "Immune Enhancing Diet" (IED) was created. Among its ingredients were glutamine, arginine, and Omega 3 fatty acids, plus a few antioxidants. The trade name of this formula is Neomune, marketed by the Otsuka Pharmaceutical (Thailand) Co. Its efficacy was similar to that of the American preparations^{21,26,29,30,32,33,34,35,36,42}.

All of the above innovations were tested in clinical research studies. None of them were expensive. More details on burn care management can be found in a previous article on the historical development of the subject in Thailand in the past 40 years. Here, I just want to emphasize on nutritional support in burns, which was a very important factor in controlling and preventing infection and sepsis in burn patients. First of all, you must know how your patient got the burn injury, the severity of the injury, and record the extent and depth of the burns, the associated injuries, current illnesses and the current body weight. Also, before giving nutritional support, you must know:

1. The calorie and protein requirement, and the ratio of non-protein to protein nitrogen;
2. The route of nutritional support, whether enteral, or parenteral, or both;
3. What kind of nutrition or diets you want for the patient;

4. The technique of administration, including the care of the parenteral central lines;

5. How to record changes in the blood chemistry, including the baseline and serial values.

When I first began to give nutritional support to burn patients in the decade between 1970 and 1980, most severe burn patients would receive small volumes of TPN on the second post-burn day, gradually increasing to a normal daily requirement, and at the same time if the GI tract begins to function we might try to give some food or nutrients by oral feeding.

The use of TPN is often associated with infection and sepsis. When we compared the infection and sepsis rates between patients receiving parenteral and enteral nutrition, these rates would be significantly higher in TPN group. Thus, during the decade between 1980 and 1990 many surgeons and physicians would provide enteral feeding if possible, giving TPN when oral feeding was not feasible or not adequate. We now prefer to give early enteral feeding if patients are able to tolerate it.

The benefits of early enteral feeding include:

1. The integrity and functions of gut are maintained;
2. The immune function is enhanced;
3. Bacterial & endotoxin translocation can be prevented;
4. Unnecessary drug use can be decreased.

Incidentally, we found that severely burned patients with less than 60% BSA who received early and adequate fluid resuscitation with no signs of shock, or with early signs of shock but were brought back to normal rapidly, did better than those with burns of over 60% BSA, in terms of tolerance to enteral nutrition as well. This also depended on the amount of fluid resuscitation the patients received in the first 24 hours. From our observations, burn patients who mostly received lactated Ringer's solution would develop edema more than if Hypertonic Saline solutions were used. In addition, to prevent multiple organ dysfunction we had to get rid of the eschar by early excision.

The establishment of SPENT and PENSA

To assemble a nutrition support team I had to establish a Division of Clinical Nutrition at Siriraj Hospital. There was no expert in nutritional support in the hospital at that time. I needed to know more about the nutritional support of our critically ill patients, and

fast. So, in addition to my increasing workload, not only in the care of severe trauma and burn patients, I had to get addition knowledge and skills for nutritional support at least for my patients. I read books, overseas journals, and attended the occasional but well-known ASPEN and ESPEN Congresses. After obtaining some working knowledge and skills, I applied them to critically ill patients in the trauma and burn units, as well as to general surgical patients who required nutritional support. For these patients I had to perform venous cut down for TPN catheterization, and later after imported percutaneous catheters became available, percutaneous central catheter placement as well, and I had to do all this by myself with the help of two part-time nurses. To prepare the TPN mixture, we also set up our own Laminar Flow room because the Hospital Pharmacy had neither personnel nor space available.

During the years 1984 to 1989, I was invited to become the Deputy Director of Siriraj Hospital. I took the opportunity to set up a Committee on Nutrition Support for Hospitalized Patients, of which I was the Chair, and this was posted and signed by the Dean of the Faculty of Medicine, Siriraj Hospital in 1989. Then a Nutrition Support Team was set up to see the consulting patients in the hospital, and making rounds at least once weekly. After we had more staff physicians returning from abroad to join the group, we were able to share our knowledge and skills with related personnel, especially ward nurses, residents, and last-year medical students. In 1985, some of my colleagues and I founded the Society of Parenteral and Enteral Nutrition of Thailand (SPENT). The activities of the society included the diffusion of knowledge and skills in nutrition support to physicians and nurses in provincial hospitals, by holding annual academic meetings for members of the Society. On some occasions we invited overseas speakers as well. SPENT is a member of PENSA, which included many countries in the Asian Region, so we had connections with similar societies all over Asia.

PENSA, or the Parenteral and Enteral Nutrition Society of Asia, was first initiated by myself and representatives of the OTSUKA Pharmaceutical Company (Thailand). We had discussed the possibility of setting up an international nutrition support meeting between the leaders in nutritional support in hospitalized patients. One or two months later we sent

our invitations to representatives of nutrition support teams of each country in the Asian region. The first meeting was set at the Dusit Hotel in Chiang Rai Province, on 15 May 1995, and 50 delegates representing at least 10 countries were present at the meeting. We discussed the possibility to establishing PENSA. The representatives unanimously agreed to establish PENSA and accepted that our one-day meeting was the first PENSA Congress Meeting. All signed their names to the relevant documents, and the Assembly assigned the city of Bangkok, Thailand to be the Headquarter of PENSA. They also elected Professor Chomchark Chuntrasakul to authorize the PENSA Center, serving as the first President of PENSA.

CONCLUSION

TPN is the principal means by which to provide some or all nutrients in patients with gastrointestinal tract impairment and in patients with greatly increased nutritional requirement, as in the severely burned or traumatized patient, particularly in the early period when a large amount of protein and energy is lost¹⁻³. However, less severely burned patients who received adequate initial fluid resuscitation with hemodynamic stability without signs of shock should tolerate early enteral feeding well. Those patients who can tolerate enteral nutrients will best respond to the care of severe burns⁷⁻⁹. Among the reasons why we prefer total enteral nutrition (TEN) included the maintenance of integrity and function of the gut, enhancement of immune functions, and the prevention of bacterial and toxin translocation, especially after shock or prolonged shock which we have seen in animals studies. Also, because central lines are used to administer TPN, infectious complications is more frequent in TPN administered patients as well¹⁴⁻¹⁸. Both TEN and TPN should be given by continuously through the tube or catheter into the upper GI tract or the central vein, respectively. Type of nutrients and diets should be selected depending on the patient's condition and disease status. We usually choose Immune Enhancing Diet (IED) for seriously ill patients such as those with severe burns, severe trauma, and those critically ill but do not have severe hepatic and renal failure, or severe sepsis. The IED should enhance the immunity in burn and trauma patients better and faster than in patients with cancer¹².

We hope both patients and professionals will gain benefits from the establishment of SPENT and PENSA. Physicians, nurses and related professionals as well as scientists and researchers will clearly benefit from, for example, acquiring advanced and updated knowledge and skills, exchanging opinions and ideas, and the feeling of unity, the friendship, and working together in a multidisciplinary environment. All of these benefits will be transferred directly to patients. The quality of patients' life will be better. Patients from neighboring countries will benefit as well.

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