The Successful Management of a Breast-Feeding Type 1 Diabetic Infant

Joanna Yuet-ling Tung*, Wai-chong Sat and Wendy Kwan

Department of Paediatrics and Adolescent Medicine, Queen Mary Hospital, The University of Hong Kong, Hong Kong

Abstract

Management of infants with type 1 diabetes is challenging to both the families and the medical team. In general, they have unpredictable oral intake and activity level, limited ability to express their needs, and low insulin requirement demanding more precise adjustment. We report a breast-feeding infant with multiple food allergies and type 1 diabetes managed smoothly with insulin pump and continuous glucose monitoring system.

Keywords: Breastfeeding; CGMS; CSII pump; Diabetes; Infant

Introduction

Management of infants with type 1 diabetes is a major challenge to both the families and the medical team. First, this is a rare condition in this age group and hence the experience is scarce. Second, this very young group has their specific age - and development - related characteristics that are distinct from other age groups. In general, they have unpredictable appetite and activity level, and limited ability to express their needs. In addition, due to their small size, their insulin requirement is much lower than older children. This makes precise adjustment of insulin difficult. On one hand, we would like to achieve good glycaemic control to reduce the risk of long-term diabetic complications. On the other hand, strict metabolic control might increase the risk of hypoglycaemia which, if recurrent, could have adverse effects on neurocognitive outcome [1]; it also could lead to hypoglycaemia unawareness and could be especially worrying in this age group. Therefore, good glycaemic control and risk of hypoglycaemia is particularly difficult to balance in this age group.

We report an infant with type 1 diabetes managed smoothly with insulin pump and continuous glucose monitoring system.

*Corresponding author: Joanna Yuet-Ling Tung, Department of Paediatrics and Adolescent Medicine, Queen Mary Hospital, The University of Hong Kong, Hong Kong, Tel: +852 22554485; E-mail: tungjy@hku.hk

Citation: Tung JY, Sat W, Kwan W (2019) The Successful Management of a Breast-Feeding Type 1 Diabetic Infant. J Neonatol Clin Pediatr 6: 032.

Accepted: May 30, 2019; Published: June 06, 2019

Copyright: © 2019 Tung JY, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
Variable Carbohydrate Content and Glycaemic Index in Breast Milk

Since the infant refused to be fed with bottle but direct breast-feeding, the volume of breast milk could not be accurately determined. Probably partly because of the variations between foremilk and hind milk composition, the carbohydrate content and glycaemic index appeared to vary a lot throughout the day. With close observation of the glucose trend in the CGMS, duration and timing of breast-feeding, we have several observations. First, foremilk has very high glycaemic index and raises glucose very quickly. This was frequently used as a very effective and convenient ‘hypoglycaemia treatment’ in this patient. Second, if the duration of breast-feeding is long enough and that mother felt that her breast engorgement was completely emptied, the glycaemic index appeared to be much lower and the glucose level would be sustainably high, sometimes requiring the use of square wave bolus to cover for that feeds.

Skin Irritation and Repeated Dislodgement

In the initial period of using both the insulin pump and CGMS, a lot of skin irritation was observed. This was ameliorated with use of skin prep before application of CGMS sensor and infusion port, followed by application of emollients and topical steroid cream to reddish areas. The dislodgement was also a serious problem with the infusion port almost falling off daily after hot showers. Difference infusion set (MiniMed Sure-T® infusion set and MiniMed Mio® infusion set) and sites (thighs and gluteal region) had been tried but the condition remained similar. Eventually, this problem was solved by prior application of skin prep and extra tape on both the sensor and the infusion port.

After around 2-week of adaptation, we finally managed to overcome some of these challenges. A satisfactory glucose profile was achieved (Figure 1). She is currently 2 years of age with normal development and her A1C remained at 6.5 % to 6.8 %. There was no further hospital admission related to her diabetes.

Discussions

Since diabetes mellitus is less common among young infants, experience in managing this very special group is, in general, scarce. Together with their unique features of variable and unpredictable physical activity and carbohydrate intake, and inability to communicate with their complaints, it makes the management of diabetes particularly challenging. The use of CSII pump integrated with CGMS system might ameliorate the difficulties; yet, the experience in this unique group is also scarce.

In general, using CSII pump therapy required more vigilance especially on the technical aspects and frequent glucose monitoring than basal/bolus insulin injection regimen. However, as reported in qualitative studies, the CSII pump therapy allows more ‘freedom, flexibility, and spontaneity in daily lives’ [2], ‘no longer having to administer painful injections’, ‘fewer restrictions on the frequency, timing and carbohydrate contents of snacks and meals; and improvements in family life and their child’s glycaemic control’ [3]. In our case, the use of CSII pump therapy, together with CGMS in this case helped both the parents and the medical team to manage this infant’s unpredictable and restricted diet issues smoothly. A smaller pump bolus could be given first before meal, and further doses could be given if she ate more. In this way, even if she refused food, it was no longer an issue as the bolus given prior to meal was only a small bolus. This flexibility relieved many anxieties and potential conflicts on eating between the caretakers and the child. In addition, a more precise insulin dose could be given as bolus (increment as low as 0.025 units) conveniently without insulin dilution. With the suspend before low function, basically our patient had minimal hypoglycaemic episodes, even with such a good HbA1c level. This would not be easily achievable with basal/bolus regime of insulin injection.

In the past decade, the use of CSII pump therapy in children has increased remarkably worldwide, though there is still significant variability among countries in the use of pump technology, contributed by both reimbursement issues and expertise in pump management. There are growing evidences on the safety and better metabolic control with CSII pump therapy when compared to MDI [4-7]. Results from a multi-centered childhood diabetes registry involving more than 16,000 type 1 diabetic children showed that, both HbA1c and daily insulin dose (U/kg/d) are lower among children treated with CSII, when compared to basal/bolus regimen, after adjustment for age, gender, and diabetes duration [5]. Similarly, results from three large, transatlantic paediatric registries involving 54,410 children and adolescents also revealed lower mean HbA1c among the pump users than those receiving insulin injection therapy [6]. It has also been reported in a large prospective cohort that, the use of CSII in adolescents is associated with lower rates of microvascular complication, independent of glycemic control or social economic status [8]. To date, there is only one retrospective study on medium term outcome of CSII pump therapy among type 1 diabetic children. It included subjects who used CSII for at least 5 years and reported significantly glycaemic improvement in terms of better A1C 1 year after CSII therapy initiation; with the use of advanced pump features associated with greater improvement in HbA1c. No significant differences were observed for body mass index, insulin requirement or other adverse events and hence it was concluded that its use is safe and effective in the pediatric population [9]. However, long-term data is not available at the moment and its benefits among infants or toddlers are not well described.

Since the insulin dose of infants could be very low, this makes the in-built occlusion detection system unreliable. For example, with the Medtronic MiniMed® 640G System, the occlusion alarm would only be triggered by an average of 2.23 units of missed insulin (standard bolus) or 1.97 units of missed insulin (quick bolus). In an infant whose total daily dose is only 5 units, this alarm system would not detect insulin delivery occlusion. Therefore, it is extremely important to have close blood glucose monitoring, desirably CGMS to prevent DKA related to tubing blockage.

The prediction of insulin requirement with respect of breast-feeding was especially challenging in this case. However, with CGMS and very close communication between the mother and the medical personnel, we have several observations. First, foremilk has very high glycaemic index and raises glucose very quickly. This was frequently used as a very effective and convenient ‘hypoglycaemia treatment’ in this patient. Second, if the duration of breast-feeding is long enough and that mother felt that her breast engorgement was completely emptied, the glycaemic index appeared to be much lower and the glucose level would be sustainably high, sometimes requiring the use of square wave bolus to cover for that feeds.
team, it is not impossible. We could, of course, suggest changing to
elemental formula for her cows and soya milk protein allergy rather
than continuing with breast-feeding to minimize all these challenges.
Nevertheless, we understand the benefits of breast-feeding and also
respected mother’s strong wish to continue with breast-feeding. We
also believe that we should try our best to facilitate our diabetic chil-
dren to grow up like other ordinary children as far as possible.

Recently, the closed loop system has been shown to improve gly-
cemic control and reduce nocturnal hypoglycemia in both young peo-
ple and adults with T1DM [10]. However, the system, similar to our
current system, was designed mainly for older children but not infants
or toddlers, and hence the aforementioned challenges would still exist
at the moment. On the other hand, with the real time CGMS, some
parents might be tempted to control their children’s blood glucose
level very tightly, which could potentially induce unnecessary stress
and anxiety. Appropriately coaching and counseling by the medical
team is needed to achieve a reasonably good metabolic control with-
out inducing too much unnecessary pressure and frustrations to the
families.

In summary, we report an infant with type 1 diabetes managed
successfully with CGMS and insulin pump. The integrated system al-
制品 a more precise glycaemic control and is safe, more physiological
and easier for the insulin administration. The success in management
does not just lie on the technology, but also close communications
and sharing of experience between the parents and the diabetic team.
A multidisciplinary team with special expertise in managing young
children with diabetes is essential.

References

1. Schwartz DD, Wasserman R, Powell PW, Axelrad ME (2014) Neurocog-
nitive outcomes in pediatric diabetes: A developmental perspective. Curr
Diab Rep 14: 533.

2. Sullivan-Bolyai S, Knafli T, Tamborlane W, Grey M (2004) Parents’ re-
flections on managing their children’s diabetes with insulin pumps. J Nurs
Scholarsh 36: 316-323.

3. Rankin D, Harden J, Noyes K, Waugh N, Barnard K, et al. (2015) Parents’
experiences of managing their child’s diabetes using an insulin pump: A
qualitative study. Diabet Med 32: 627-634.

4. Olsen B, Johannesen J, Fredheim S, Svensson J (2015) Danish society
for childhood and adolescent diabetes. Insulin pump treatment; increasing
prevalence, and predictors for better metabolic outcome in danish children
and adolescents with type 1 diabetes. Pediatr Diabetes 16: 256-262.

5. Szypowska A, Schwandt A, Svensson J, Shalitin S, Cardona-Hernandez R,
et al. (2016) Insulin pump therapy in children with type 1 diabetes: Analy-
sis of data from the SWEET registry. Pediatr Diabetes 23: 38-45.

6. Sherr JL, Hermann JM, Campbell F, Foster NC, Hofer SE, et al. (2016)
Use of insulin pump therapy in children and adolescents with type 1 diabe-
tes and its impact on metabolic control: Comparison of results from three
large, transatlantic paediatric registries. Diabetologia 59: 87-91.

7. Levy-Shraga Y, Lerner-Geva L, Modan-Moses D, Graph-Barel C, Ma-
zor-Aronovitch K, et al. (2013) Benefits of continuous subcutaneous in-
sulin infusion (CSII) therapy in preschool children. Exp Clin Endocrinol
Diabetes 121: 225-229.

8. Zabeen B, Craig ME, Virk SA, Pryke A, Chan AK, et al. (2016) Insulin
Pump Therapy Is Associated with Lower Rates of Retinopathy and Periph-
eral Nerve Abnormality. PloS One 11: 0153033.

9. Mameli C, Scaramuzza AE, Ho J, Cardona-Hernandez R, Suarez-Ortega
L, et al. (2014) A 7-year follow-up retrospective, international, multicenter
study of insulin pump therapy in children and adolescents with type 1 dia-
betes. Acta Diabetol 51: 205-210.

10. Kumareswaran K, Elleri D, Allen JM, Harris J, Xing D, et al. (2011) Me-
ta-analysis of overnight closed-loop randomized studies in children and
adults with type 1 diabetes: The Cambridge cohort. Diabetes Sci Technol
5: 1352-1362.
Journal of Anesthesia & Clinical Care
Journal of Addiction & Addictive Disorders
Advances in Microbiology Research
Advances in Industrial Biotechnology
Journal of Agronomy & Agricultural Science
Journal of AIDS Clinical Research & STDs
Journal of Alcoholism, Drug Abuse & Substance Dependence
Journal of Allergy Disorders & Therapy
Journal of Alternative, Complementary & Integrative Medicine
Journal of Alzheimer’s & Neurodegenerative Diseases
Journal of Angiology & Vascular Surgery
Journal of Animal Research & Veterinary Science
Archives of Zoological Studies
Archives of Urology
Journal of Atmospheric & Earth-Sciences
Journal of Aquaculture & Fisheries
Journal of Biotech Research & Biochemistry
Journal of Brain & Neuroscience Research
Journal of Cancer Biology & Treatment
Journal of Cardiology & Neurocardiovascular Diseases
Journal of Cell Biology & Cell Metabolism
Journal of Clinical Dermatology & Therapy
Journal of Clinical Immunology & Immunotherapy
Journal of Clinical Studies & Medical Case Reports
Journal of Community Medicine & Public Health Care
Current Trends: Medical & Biological Engineering
Journal of Cytology & Tissue Biology
Journal of Dentistry: Oral Health & Cosmesis
Journal of Diabetes & Metabolic Disorders
Journal of Dairy Research & Technology
Journal of Emergency Medicine Trauma & Surgical Care
Journal of Environmental Science: Current Research
Journal of Food Science & Nutrition
Journal of Forensic, Legal & Investigative Sciences
Journal of Gastroenterology & Hepatology Research
Journal of Gerontology & Geriatric Medicine
Journal of Genetics & Genomic Sciences
Journal of Hematology, Blood Transfusion & Disorders
Journal of Human Endocrinology
Journal of Hospice & Palliative Medical Care
Journal of Internal Medicine & Primary Healthcare
Journal of Infectious & Non Infectious Diseases
Journal of Light & Laser: Current Trends
Journal of Modern Chemical Sciences
Journal of Medicine: Study & Research
Journal of Nanotechnology: Nanomedicine & Nanobiotechnology
Journal of Neuroradiology & Clinical Pediatrics
Journal of Nephrology & Renal Therapy
Journal of Non Invasive Vascular Investigation
Journal of Nuclear Medicine, Radiology & Radiation Therapy
Journal of Obesity & Weight Loss
Journal of Orthopedic Research & Physiotherapy
Journal of Otolaryngology, Head & Neck Surgery
Journal of Protein Research & Bioinformatics
Journal of Pathology Clinical & Medical Research
Journal of Pharmacology, Pharmaceutics & Pharmacovigilance
Journal of Physical Medicine, Rehabilitation & Disabilities
Journal of Plant Science: Current Research
Journal of Psychiatry, Depression & Anxiety
Journal of Pulmonary Medicine & Respiratory Research
Journal of Practical & Professional Nursing
Journal of Reproductive Medicine, Gynaecology & Obstetrics
Journal of Stem Cells Research, Development & Therapy
Journal of Surgery: Current Trends & Innovations
Journal of Toxicology: Current Research
Journal of Translational Science and Research
Trends in Anatomy & Physiology
Journal of Vaccines Research & Vaccination
Journal of Virology & Antivirals
Archives of Surgery and Surgical Education
Sports Medicine and Injury Care Journal
International Journal of Case Reports and Therapeutic Studies

Submit Your Manuscript: http://www.heraldopenaccess.us/Online-Submission.php